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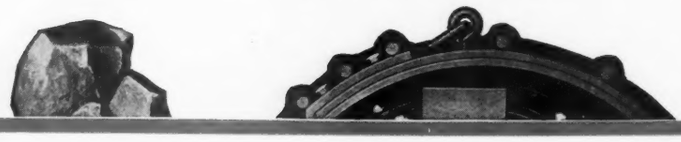

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Much to Be Learned From 1929 Experiences of Industry

Writers of newspaper annuals report great reluctance on the part of industrial leaders to commit themselves about the immediate future of business; the inference is that the situation is too complicated. Having just completed rereading some of the prophecies made a year ago, and as recently as six months ago, it is our guess that industrial leaders, recalling these prophecies, and perhaps having been a little singed in the stock market, by way of emphasis, are conservative about further risking their business reputations as prophets. Practically all predicted a year of construction equal to 1928, although a few did hedge on the prospective volume of residence construction. As recently as May, one of our most prominent economists, who is invariably widely quoted, said: "A drop in business activity may take place before the end of the year, but money rates will be a relatively unimportant and only an indirect factor in it. Unfavorable agricultural conditions, and reaction from the excessive rate of automobile output, and other such factors in the actual business situation are likely to be more influential. Money rates in combination with tariff revision, will probably affect our export more than our domestic trade." In August one of the leading banker publicists of the country was proclaiming: "The generally vigorous and persistent advance in the earnings of the leading industrial corporations during the last five years probably constitutes the most important single cause behind this unprecedented advance in stock prices. Investors are buying stocks, instead of bonds and mortgages, because they realize, if corporate earnings continue to advance, yields will eventually become adequate."

Not So Many Prophets

The fact is, of course, that high money rates had a whole lot to do with it by slowing up construction—"the balance wheel of all industry." Contrary to prediction the agricultural situation was considerably improved, and our export trade instead of falling off is going stronger than almost any branch of domestic trade. We will say for the banker who justified August stock prices that he has given the best explanation of just what did happen, of any we have read: "When stock prices discount the future too far in advance a great many people make money by selling their stocks and taking their profits. These winnings are not an addition to national wealth; they are an overdraft on national savings. In reality the unsuccessful speculators [they are not referred to as investors here!—Editor] are now paying back the profits that successful speculators took out of the market before the break. When these profits were taken out, and in part freely spent, they had a stimulating effect on business. Now that savings and borrowings are being drawn upon to pay them back the effect on business is depressing."

What Really Happened

In a nut-shell business men have got to go back to work and produce and market products to make good the some billions of money value lost in stock price depreciation—to make good the overdraft on the future with honest-to-goodness national wealth. It was a hectic year, but if it has rid the population generally, even only temporarily, of the fallacy of trying to get something for nothing, it has undoubtedly done a world of good.

Apparently, considering building and construction of all kinds, there was a slump of from 5 to 10% compared with 1928 figures, which it will be recalled, exceeded any previous year. Contracts let fell off from 18 to 20%, which does not look so good for an immediate revival of construction. Residential building fell off 25 to 30%, from 1928 figures. Increases in construction were confined to the commercial, industrial and public utility fields, public works, etc., which gained about 12%—the industrial, commercial and public utility part of construction was probably largely financed from profits and surplus and sale of new stocks (of which there was a tremendous volume in 1929), and public works from bond issues that were made long before the remarkable rise and fall of the stock market.

Construction Down 10%

It was a year of great contrasts. New high records were made in bank debits, in electricity output, in union wage scales, in mail order sales, in chain store sales, in depart-

ment store sales, in automobile output, in steel ingot output, in corporate financing and in business profits. Building material corporation profits, as a whole, from semi-annual reports at mid-year, showed profits 36% better than for the first six months of 1928, notwithstanding the fact that building material prices were at about the same level, while building trades' wages went up about 5%. During the second half of the year building material prices generally slumped about 5%, so the year ends with building costs about the same level as a year ago. The brilliant expectations for an enormous public works program were cut by high money rates, which some months previous (it is now known) seriously affected residential building programs.

Cement Shipments Less Than 1928

The largest part of the business of rock products producers comes from construction, hence the industry suffered from a slackening of construction. The production and shipments of portland cement were probably 3 to 5% less than 1928—the first year since 1921 to register a loss from the preceding year. Sand, gravel and crushed stone production suffered but slight losses, if any. The reason for this is that crushed stone is used for railway ballast, furnace flux, etc., for which the demand was greater than in 1928; sand, gravel and crushed stone were also used extensively in 1929 for top surfacing secondary roads, a growing outlet, where cement has not yet found a large market. Lime and gypsum production probably was 15 to 20% less than in 1928 because of the falling off in residential building. The industrial demand for lime probably exceeded that in 1928, as it did for agricultural lime and limestone.

Experiences of Competitive and Customer Industries

The chemical industries are large users of lime, limestone, phosphate rock, silica, etc.; general conditions in the chemical industry were satisfactory, with business substantially greater than the year before. In heavy chemicals the increase in production was probably 10 to 15%. The fertilizer industry, chief user of phosphate rock, was off about 5% from 1928, but exports were maintained or increased. There was a considerably larger production and consumption of raw rock phosphate by farmers in the Middle West. Paint manufacturers, buyers of pulverized minerals such as limestone and silica, sold 4% more than in 1928 at nearly 6% better prices—a result of aggressive promotion and advertising. The paper industry, a big consumer of lime, limestone, soda ash, etc., had an unprecedented volume of business in 1929—and expects the same in 1930. Steel production in 1929 was a record for all time, and steel manufacture requires large quantities of limestone. On the other side of the picture, however, steel is a competitor of concrete in most industrial and commercial building, and the structural steel industry enjoyed an extremely prosperous year despite of the 10% decline in building generally; and this increase was recorded in the face of an advancing wholesale price of the material. This looks as if cement manufacturers did not get their previous proportion of commercial and industrial building—and apparently demonstrates again that *rising* prices of building materials is one of the best sales arguments. Moreover it will be recalled that the structural steel fabricators recently organized a very efficient and aggressive promotional organization, modeled admittedly after the Portland Cement Association, and it has been doing some very effective advertising. All of which goes to show that no producer or manufacturer can be sure of his principal markets for any length of time, without being perpetually on his toes to guard and extend them. Brick, another competitor of cement, on the other hand, suffered far worse than cement. Brick consumption in 1928 fell off 25%, as compared with 1927; and was off 40% in 1929 compared with 1928; and brick manufacturers were not entirely asleep. Paving brick manufacturers, strange as it may seem, actually reported a better year in 1929 than in 1928; and they profess to see even better prospects in 1930. Lumber production fell off to almost as large a percentage as residential building—about 20%; and this industry looks for 10% less business the first six months of this year than in 1929.

Highway Prospects For 1930

Probably highway construction offers the largest single market for rock products as a whole. Promises made to President Hoover by the governors of the various states seem to assure a considerably larger volume of highway construction in 1930 than in 1929. Highway construction reached its peak in 1928; it was appreciably less in dollars and cents in 1929. But, in all talk of highway improvement today emphasis is placed on the improvement of secondary roads with some cheap kind of surfacing. This means, in many instances, local sand, gravel or crushed stone; seldom portland cement and often not commercial aggregates. According to President Hoover the progress made in road improvement to date accounts for about 50,000 miles of all types per annum, of which some 12,000 miles are of the more durable types; the whole absorbing about $1,660,000,000 per year. There are still 2,500,000 miles of unimproved dirt roads and nearly 5,000,000 of the country's 6,250,000 farms are on these dirt roads; less than 500,000 farms are on year-round hard roads. So we are not likely to see the end of road building soon, or even a let-up of popular enthusiasm for road building, although in 1929 some 16 states actually curtailed their highway construction activities.

Immense sums are now available every year from gasoline taxation and motor vehicle licenses to keep up highway improvement, without bond issues, but the situation is not without some depressing aspects. The agitation for improving farm roads is likely to lead to the dissipation of large sums (in the aggregate) on improvements of doubtful economic value. This is emphasized by the fact that beginning this month every state in the Union except seven will be giving some portion of its gasoline tax receipts to the counties, where it may not necessarily be spent for highway improvement at all, in many instances.

Consequently it is time for those interested in hard-surfaced pavements, particularly, to wake up; and for all to be on guard against the diversion of highway funds.

Building Prospects in 1930

According to estimates, or promises, given President Hoover, railway and public utility construction in 1930 will be as good as in 1929. These industries probably have the money in sight. From the falling off of contracts let for industrial and commercial building during the last two or three months it would seem that we are running through this kind of building that is already financed, and must await new financing, or more favorable conditions for new financing. As to the actual demand for new commercial and industrial building one man's guess is as good as another's. With easy money there is always a large amount of such building that is not absolutely essential, but which does furnish more efficient, more attractive and probably more profitable structures; still the old buildings could be continued in use much longer if necessary. Office building owners and managers predict a surplus of 16% in rental space by May, 1930.

As regards residential building there is no reason under the sun why every producer of building materials should not have been fully forewarned of the slump in 1929. They might easily have looked beyond the predictions of architects and the statistics of building permits. Here are some of the facts brought out in the Hoover conferences, which might have been known and acted on months before: The decline in residential construction has followed a drop in house rents, which reached their maximum in 1924, and have been declining ever since; not since the early months of the year had there been the usual flow of moneys to building and loan associations, and with increased withdrawal demands made in the last three quarters of the year, there is not now sufficient available funds with which to meet all demands for loans for home building purposes. There are more than the usual number of applications for good loans, partly because funds which have been available from insurance companies, mortgage companies and banks for this purpose have been withdrawn, and this has increased the demand upon building and loan associations. The prospects of home building, to building and loan association officials, do not appear particularly encouraging for the next six months. New business in life insurance is hard to get and collections for some months past have been slow, policy holders taking advantage of various devices for deferring payment of premiums; a similar situation exists as to the collection of mortgage loan interest. Prospects for the next six months indicate that greater effort is necessary to make a showing as good as for the corresponding period of 1929. Casualty insurance companies' prospects for the first six months of 1930 compared to the same period of 1929 is for reduced income due to probable reduced payrolls underlying workmen's compensation insurance premiums. Fire insurance companies' prospects for the first six months of 1930 as compared with the same period of 1929 is for reduced income because of attempts of the owning public to economize in this way, and because of the reduction in values, and for increased losses on account of increased moral hazards. These facts are of vital interest because a large part of the money for residential building comes from insurance company funds, in one way or another. The real estate business has been on the decline for several years, and 1929 is said to have been one of the worst ever. We are calling attention to these facts not to be pessimistic, but to emphasize data and information, even statistics, upon which to predict construction, largely overlooked, but vital.

Must Do As Well As Talk

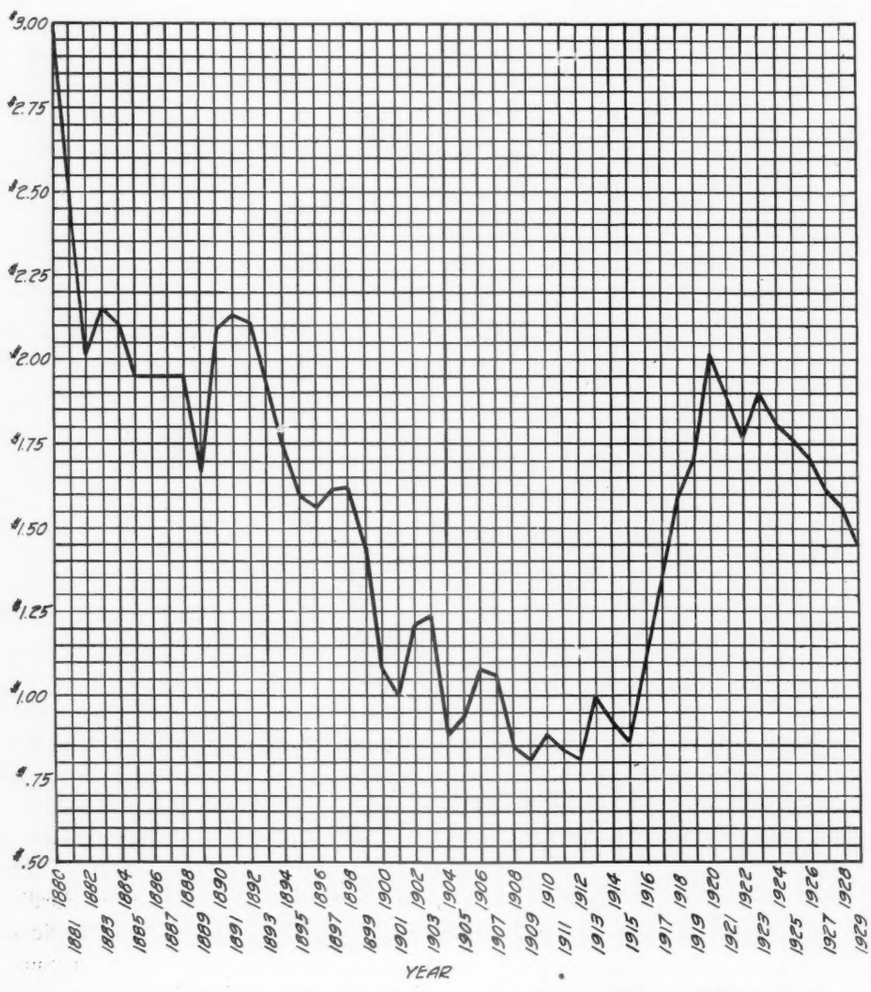
Of the country's greatest industrial leaders who conferred with President Hoover, only one has yet fully demonstrated the strength of his expressed convictions—Henry Ford. What he said and did would have been laughed or sneered at by many business and industrial leaders of not so long ago; but not now. He said, leaving the Hoover conference: "Over-production can never occur until every need is supplied; but the first need is the need of money. Money in the people's hands represents purchasing power. In this country the purchasing power of the people has been practically used up, and still they have not been able to buy all that they must have. I therefore suggest the need of increasing the purchasing power of our principal customers—the American people. . . . Nearly everything in this country is too high priced. The only thing that should be high priced is the man who works. Wages must not come down; they must not even stay at their present level; they must go up. . . . To make wages better and keep prices down requires that business men come back into business—as many are doing since stocks came down. There is no startling, miraculous plan of recovery and advance; it is all as plain and familiar as a copy-book maxim. The situation promises much better than it did a year ago. We were on the threshold of a necessary change anyhow, and if some men stumbled when they crossed it, it was only because their eyes were elsewhere. A year ago the country was expecting something to happen—now that it is over and passed the road ahead is clear." And Henry Ford straightaway raised the wages of every one of his tens of thousands employes; and since then has told how many cars he is going to sell this year to pay these increased wages.

And no less a hard-headed, practical executive than Chas. M. Schwab recently said: "Research is needed not only in knowing how to produce better, but also in the direction of knowing how much to produce and where. . . . It even extends into the field of management and labor relations." No longer are employes hired and fired with every fluctuation in business volume. Mass production depends on mass demand and sources of mass demand must be protected. That is what Henry Ford has actually set out to do, and what other business executives must do, each in his own way. They may not accept Henry Ford's philosophy, but they must recognize his example of leadership; leadership is more than advice; it is action in conducting your own business on sound principles.

The Portland Cement Industry in 1929

THE PASSING of 1929 will doubtless be looked on throughout the portland cement industry with relief. For the first time since 1921 production and shipments showed a recession from those of previous years—in other words, a saturation point was reached for the time being at least. From U. S. Bureau of Mines statistics for the entire year except December, and with conservative estimates for December, it would appear that production in 1929 amounted to 169,137,000 bbl. compared with 175,968,000 bbl. in 1928, a loss of 6,831,000 bbl. or 3.9%; while shipments in 1929 probably were about 169,647,000 bbl. compared with 175,455,000 bbl. in 1928, a loss of 5,808,000 bbl. or 3.3%. Nine new mills and a grinding plant added between 9,000,000 and 10,000,000 bbl. to the producing capacity of the industry in 1929, while improvements and additions to existing plants probably added between 3,000,000 and 4,000,000 bbl.; at the close of the year, then, the capacity of existing plants—capable of operation, at least—is about 14,000,000 more than at the end of 1928, when it was estimated to be about 243,000,000 bbl., so that present capacity must be about 257,000,000 bbl. annually. On that basis not over 66%, or two-thirds, of the available capacity to produce was utilized. At the peak of production for the year—the month of August—only 86% of available capacity was utilized. And until November, stocks of finished cement on hand were uniformly more than for the same periods of 1928, notwithstanding the generally less demand than in 1928.

Prices declined throughout the year, although the decline in the second half of the year was most pronounced, and large commitments were entered into during the last few months at prices much lower than those earlier in the year. The average net mill price in 1928, according to the United States Bureau of Mines, was $1.57 per bbl. Declines were reported this year ranging from nothing to 25%, with an average of 10%, so that the average mill price in 1929 was probably about $1.45. The Pacific Northwest is the only section of the country where 1928 prices held, notwithstanding the fact that shipments in this section apparently suffered the worst decline of any. The maximum price-cutting was in the Southeast—25%. The East generally suffered a 15% cut, all in the second half of the year, from 1928 prices. Prices were raised again to previous levels in the East toward the end of the year, but not before much damage had been done.



Average barrel prices of portland cement, by years, 1880 to 1920, inclusive

The value of the 170,000,000 bbl. shipped in 1929 was therefore approximately $245,000,000, compared with $276,000,000 for 176,000,000 in 1928. This is a loss of about $30,000,000, of profits and reserves, since no portland cement company went into receivership, and there were no wage cuts worth mentioning. Costs of operation were undoubtedly reduced at many plants in some proportion to reduction of output, but of course not in direct ratio to output, since it costs very nearly as much to operate the average mill at two-thirds capacity as at full capacity. Whatever savings were made in operation were very likely spent in additional sales and distribution costs, because competition was the most severe in many years, and many manufacturers were accused of assuming distribution costs that properly belonged to the user or dealer.

Production and Shipments by Districts

The accompanying tables show the production and shipments by districts, month by month, compared with corresponding statistics for 1928. Only four districts showed a gain in shipments—(1) Maine and New York; (2) Western Missouri, Nebraska, Kansas, Oklahoma and Arkansas; (3) Texas; (4) Colorado, Montana, Utah, Wyoming and Idaho. In only two of these districts did production exceed 1928—(1) Western Missouri, Nebraska, Kansas, Oklahoma and Arkansas; (2) Texas. Texas showed an increase in production of 15% over 1929 and an increase of 13% in shipments—the largest gains of any section. It will be noted that these gains were practically all made (with the exception of Maine and New York) in a section of the country that has not shown much construction activity for the past few years—and one probably farthest removed from so-called Wall Street activities, influences, or stock gambling. The increased consumption of cement in this part of the country is largely accounted for by increased activity in public works and in the construction of hydroelectric and irrigation dams and works.

Imports for the first 10 months of the year amounted to 1,546,974 bbl. compared with 2,042,124 bbl. for the same period in 1928. Total imports for 1928 were 2,284,085 bbl.; probably the total for 1929 will be about 1,800,000 bbl. Whether the falling off of imports was due to agitation against the use of imported cement in many localities, or to the fact that domestic prices were so low as to discourage importations, remains to be seen. Unimportant as this imported cement appears in quantity, it helped very

EASTERN PENNSYLVANIA, NEW JERSEY AND MARYLAND

Month	—Production— 1928	1929	Increase	Decrease	—Shipments— 1928	1929	Increase	Decrease	Stocks at end of month
January	2,351,000	2,410,000	59,000	.....	1,545,000	1,387,000	.....	158,000	6,087,000
February	2,135,000	2,199,000	64,000	.....	1,456,000	1,354,000	.....	102,000	6,933,000
March	2,512,000	2,513,000	1,000	.....	2,396,000	2,506,000	110,000	.....	6,941,000
April	3,084,000	3,005,000	.....	79,000	3,303,000	3,165,000	.....	138,000	6,781,000
May	3,823,000	3,541,000	.....	282,000	4,200,000	3,967,000	.....	233,000	6,355,000
June	4,065,000	3,697,000	.....	368,000	4,081,000	4,201,000	120,000	.....	5,852,000
July	3,832,000	3,709,000	.....	123,000	4,042,000	4,171,000	129,000	.....	5,389,000
August	4,024,000	3,941,000	.....	83,000	4,403,000	4,584,000	181,000	.....	4,777,000
September	3,610,000	3,600,000	.....	10,000	4,141,000	3,925,000	.....	216,000	4,452,000
October	3,743,000	3,571,000	.....	172,000	4,753,000	4,043,000	.....	710,000	4,000,000
November	3,338,000	2,956,000	.....	382,000	3,153,000	2,932,000	.....	221,000	4,024,000
December	2,760,000	2,200,000*	.....	560,000*	1,963,000	1,500,000	.....	463,000*	.....
Totals	39,277,000	37,342,000*	.....	1,935,000*	39,436,000	37,735,000*	.....	1,701,000*	.....

*Estimated.

NEW YORK AND MAINE

Month	—Production— 1928	1929	Increase	Decrease	—Shipments— 1928	1929	Increase	Decrease	Stocks at end of month
January	549,000	405,000	.....	144,000	316,000	257,000	.....	59,000	1,804,000
February	305,000	412,000	107,000	.....	288,000	232,000	.....	56,000	1,984,000
March	587,000	593,000	6,000	.....	499,000	504,000	5,000	.....	2,073,000
April	831,000	900,000	69,000	.....	850,000	732,000	.....	118,000	2,242,000
May	1,291,000	1,137,000	.....	154,000	1,239,000	1,184,000	.....	55,000	2,195,000
June	1,208,000	1,197,000	.....	11,000	1,264,000	1,383,000	119,000	.....	2,009,000
July	1,207,000	1,366,000	159,000	.....	1,428,000	1,609,000	181,000	.....	1,765,000
August	1,320,000	1,449,000	129,000	.....	1,519,000	1,747,000	228,000	.....	1,467,000
September	1,205,000	1,241,000	36,000	.....	1,355,000	1,434,000	79,000	.....	1,274,000
October	1,204,000	1,129,000	.....	75,000	1,375,000	1,407,000	32,000	.....	996,000
November	962,000	848,000	.....	114,000	725,000	738,000	13,000	.....	1,107,000
December	812,000	600,000*	.....	212,000*	495,000	500,000*	5,000*	.....	.....
Totals	11,481,000	11,277,000*	.....	204,000*	11,353,000	11,727,000*	374,000*	.....	.....

*Estimated.

OHIO, WESTERN PENNSYLVANIA AND WEST VIRGINIA

Month	—Production— 1928	1929	Increase	Decrease	—Shipments— 1928	1929	Increase	Decrease	Stocks at end of month
January	752,000	818,000	66,000	.....	453,000	430,000	.....	23,000	3,224,000
February	978,000	829,000	.....	149,000	487,000	442,000	.....	45,000	3,611,000
March	851,000	908,000	57,000	.....	834,000	869,000	35,000	.....	3,650,000
April	1,321,000	1,401,000	80,000	.....	1,154,000	1,274,000	120,000	.....	3,777,000
May	1,812,000	1,595,000	.....	217,000	1,898,000	1,660,000	.....	238,000	3,711,000
June	1,720,000	1,885,000	165,000	.....	1,759,000	2,046,000	287,000	.....	3,550,000
July	1,843,000	2,075,000	232,000	.....	2,172,000	2,246,000	74,000	.....	3,435,000
August	2,047,000	2,190,000	143,000	.....	2,687,000	2,431,000	.....	256,000	3,152,000
September	2,276,000	1,919,000	.....	357,000	2,559,000	2,386,000	.....	173,000	2,685,000
October	2,120,000	1,731,000	.....	389,000	2,294,000	2,176,000	.....	118,000	2,240,000
November	1,587,000	1,537,000	.....	50,000	1,133,000	1,197,000	64,000	.....	2,580,000
December	1,029,000	900,000*	.....	129,000*	606,000	550,000*	.....	56,000*	.....
Totals	18,336,000	17,788,000*	.....	548,000*	18,036,000	17,707,000*	.....	329,000*	.....

*Estimated.

MICHIGAN

Month	—Production— 1928	1929	Increase	Decrease	—Shipments— 1928	1929	Increase	Decrease	Stocks at end of month
January	379,000	704,000	325,000	.....	300,000	266,000	.....	34,000	2,435,000
February	303,000	525,000	222,000	.....	319,000	302,000	.....	17,000	2,658,000
March	560,000	476,000	.....	84,000	505,000	543,000	38,000	.....	2,591,000
April	1,056,000	964,000	.....	92,000	846,000	897,000	51,000	.....	2,659,000
May	1,280,000	1,387,000	107,000	.....	1,507,000	1,322,000	.....	185,000	2,724,000
June	1,456,000	1,466,000	10,000	.....	1,731,000	1,720,000	.....	11,000	2,469,000
July	1,662,000	1,432,000	.....	230,000	1,872,000	1,964,000	92,000	.....	1,979,000
August	1,614,000	1,581,000	.....	33,000	2,070,000	2,290,000	220,000	.....	1,238,000
September	1,573,000	1,519,000	.....	54,000	1,991,000	1,800,000	.....	191,000	961,000
October	1,550,000	1,437,000	.....	113,000	1,673,000	1,323,000	.....	350,000	1,075,000
November	1,409,000	1,228,000	.....	181,000	811,000	667,000	.....	144,000	1,636,000
December	1,058,000	750,000*	.....	308,000*	416,000	350,000*	.....	66,000*	.....
Totals	13,900,000	13,469,000*	.....	431,000*	14,041,000	13,444,000*	.....	597,000*	.....

*Estimated.

WISCONSIN, ILLINOIS, INDIANA AND KENTUCKY

Month	—Production— 1928	1929	Increase	Decrease	—Shipments— 1928	1929	Increase	Decrease	Stocks at end of month
January	1,354,000	946,000	.....	408,000	519,000	328,000	.....	191,000	3,423,000
February	901,000	862,000	.....	39,000	578,000	373,000	.....	205,000	3,911,000
March	933,000	1,086,000	153,000	.....	1,004,000	948,000	.....	56,000	4,049,000
April	1,438,000	1,903,000	465,000	.....	1,670,000	1,608,000	.....	62,000	4,343,000
May	2,384,000	2,065,000	.....	319,000	2,793,000	2,356,000	.....	437,000	4,052,000
June	2,446,000	2,305,000	.....	141,000	2,443,000	2,707,000	264,000	.....	3,650,000
July	2,375,000	2,354,000	.....	21,000	2,863,000	2,837,000	.....	26,000	3,168,000
August	2,548,000	2,425,000	.....	123,000	3,076,000	3,275,000	199,000	.....	2,318,000
September	2,411,000	2,182,000	.....	229,000	3,085,000	2,759,000	.....	326,000	1,740,000
October	2,238,000	1,935,000	.....	303,000	2,646,000	2,346,000	.....	300,000	1,329,000
November	1,973,000	1,760,000	.....	213,000	1,272,000	1,219,000	.....	53,000	1,86º 000
December	1,683,000	1,400,000*	.....	283,000*	644,000	600,000*	.....	44,000*	.....
Totals	22,684,000	21,223,000*	.....	1,461,000*	22,593,000	21,356,000*	.....	1,237,000*	.....

*Estimated.

VIRGINIA, TENNESSEE, ALABAMA, GEORGIA, FLORIDA AND LOUISIANA

Month	—Production— 1928	1929	Increase	Decrease	—Shipments— 1928	1929	Increase	Decrease	Stocks at end of month
January	1,109,000	884,000	.....	225,000	938,000	824,000	.....	114,000	1,955,000
February	1,037,000	887,000	.....	150,000	922,000	662,000	.....	260,000	2,180,000
March	1,268,000	1,028,000	.....	240,000	1,298,000	960,000	.....	338,000	2,248,000
April	1,381,000	1,117,000	.....	264,000	1,276,000	1,251,000	.....	25,000	2,114,000
May	1,337,000	1,276,000	.....	61,000	1,500,000	1,301,000	.....	199,000	2,090,000
June	1,391,000	1,251,000	.....	140,000	1,409,000	1,278,000	.....	131,000	2,063,000
July	1,414,000	1,216,000	.....	198,000	1,419,000	1,520,000	101,000	.....	1,818,000
August	1,508,000	1,450,000	.....	58,000	1,699,000	1,644,000	.....	55,000	1,623,000
September	1,433,000	1,298,000	.....	135,000	1,475,000	1,311,000	.....	164,000	1,610,000
October	1,561,000	1,306,000	.....	255,000	1,576,000	1,419,000	.....	157,000	1,498,000
November	1,413,000	1,085,000	.....	328,000	1,350,000	1,025,000	.....	325,000	1,557,000
December	1,084,000	800,000*	.....	284,000*	870,000	800,000*	.....	70,000*	.....
Totals	15,936,000	13,598,000*	.....	2,338,000*	15,732,000	13,995,000*	.....	1,737,000*	.....

*Estimated.

EASTERN MISSOURI, IOWA, MINNESOTA AND SOUTH DAKOTA

Month	—Production— 1928	1929	Increase	Decrease	—Shipments— 1928	1929	Increase	Decrease	Stocks at end of month
January	1,107,000	1,198,000	91,000	.....	276,000	201,000	.....	75,000	3,891,000
February	747,000	678,000	.....	69,000	319,000	215,000	.....	104,000	4,353,000
March	687,000	644,000	.....	43,000	730,000	700,000	.....	30,000	4,297,000
April	1,142,000	1,150,000	8,000	.....	1,154,000	1,086,000	.....	68,000	4,362,000
May	1,766,000	1,548,000	.....	218,000	2,143,000	1,649,000	.....	494,000	4,261,000
June	1,715,000	1,607,000	.....	108,000	2,109,000	2,123,000	14,000	.....	3,745,000
July	1,736,000	1,569,000	.....	167,000	2,323,000	2,223,000	.....	100,000	3,092,000
August	1,901,000	1,578,000	.....	323,000	2,372,000	2,589,000	217,000	.....	2,081,000
September	1,735,000	1,670,000	.....	65,000	2,236,000	2,325,000	89,000	.....	1,426,000
October	1,599,000	1,718,000	119,000	.....	1,705,000	1,870,000	165,000	.....	1,273,000
November	1,283,000	1,344,000	61,000	.....	777,000	742,000	.....	35,000	1,876,000
December	1,269,000	1,300,000*	31,000*	.....	359,000	300,000*	.....	59,000*	.....
Totals	16,687,000	16,004,000*	.....	633,000*	16,503,000	16,023,000*	.....	480,000*	.....

*Estimated.

WESTERN MISSOURI, NEBRASKA, KANSAS, OKLAHOMA AND ARKANSAS

Month	—Production— 1928	1929	Increase	Decrease	—Shipments— 1928	1929	Increase	Decrease	Stocks at end of month
January	476,000	614,000	138,000	.....	451,000	349,000	.....	102,000	1,610,000
February	487,000	482,000	.....	5,000	495,000	311,000	.....	184,000	1,782,000
March	645,000	620,000	.....	25,000	829,000	905,000	76,000	.....	1,497,000
April	906,000	932,000	26,000	.....	803,000	1,034,000	231,000	.....	1,416,000
May	1,188,000	1,117,000	.....	71,000	1,181,000	1,007,000	.....	174,000	1,527,000
June	1,055,000	1,089,000	34,000	.....	1,058,000	1,126,000	68,000	.....	1,492,000
July	1,027,000	1,159,000	132,000	.....	1,227,000	1,370,000	143,000	.....	1,269,000
August	1,181,000	1,430,000	249,000	.....	1,312,000	1,773,000	461,000	.....	926,000
September	1,201,000	1,422,000	221,000	.....	1,270,000	1,542,000	272,000	.....	798,000
October	1,190,000	1,331,000	141,000	.....	1,361,000	1,508,000	147,000	.....	621,000
November	884,000	1,176,000	292,000	.....	726,000	788,000	62,000	.....	1,009,000
December	691,000	800,000*	109,000*	.....	507,000	510,000*	3,000*	.....	.....
Totals	10,931,000	12,172,000*	1,241,000*	.....	11,220,000	12,223,000*	1,003,000*	.....	.....

*Estimated.

TEXAS

Month	—Production— 1928	1929	Increase	Decrease	—Shipments— 1928	1929	Increase	Decrease	Stocks at end of month
January	463,000	466,000	3,000	.....	447,000	459,000	12,000	.....	530,000
February	460,000	399,000	.....	61,000	423,000	416,000	.....	7,000	513,000
March	552,000	527,000	.....	25,000	562,000	594,000	32,000	.....	446,000
April	557,000	622,000	65,000	.....	538,000	625,000	87,000	.....	443,000
May	531,000	655,000	124,000	.....	610,000	563,000	.....	47,000	535,000
June	540,000	554,000	14,000	.....	573,000	579,000	6,000	.....	510,000
July	561,000	701,000	140,000	.....	603,000	666,000	63,000	.....	546,000
August	519,000	707,000	188,000	.....	623,000	786,000	163,000	.....	466,000
September	544,000	707,000	163,000	.....	520,000	680,000	160,000	.....	492,000
October	617,000	777,000	160,000	.....	552,000	743,000	191,000	.....	527,000
November	529,000	661,000	132,000	.....	451,000	523,000	72,000	.....	665,000
December	472,000	550,000*	78,000*	.....	375,000	460,000*	85,000*	.....	.....
Totals	6,345,000	7,326,000*	981,000*	.....	6,277,000	7,094,000*	817,000*	.....	.....

*Estimated.

COLORADO, MONTANA, UTAH AND WYOMING

Month	—Production— 1928	1929	Increase	Decrease	—Shipments— 1928	1929	Increase	Decrease	Stocks at end of month
January	176,000	50,000	.....	126,000	67,000	61,000	.....	6,000	524,000
February	108,000	74,000	.....	34,000	85,000	57,000	.....	28,000	541,000
March	160,000	57,000	.....	103,000	174,000	144,000	.....	30,000	451,000
April	200,000	217,000	17,000	.....	217,000	259,000	42,000	.....	492,000
May	311,000	363,000	52,000	.....	267,000	334,000	67,000	.....	521,000
June	275,000	325,000	50,000	.....	299,000	336,000	37,000	.....	506,000
July	260,000	322,000	62,000	.....	291,000	299,000	8,000	.....	529,000
August	290,000	357,000	67,000	.....	364,000	368,000	4,000	.....	518,000
September	321,000	314,000	.....	7,000	316,000	358,000	42,000	.....	475,000
October	199,000	323,000	124,000	.....	282,000	346,000	64,000	.....	451,000
November	238,000	120,000	.....	118,000	145,000	119,000	.....	26,000	453,000
December	206,000	150,000*	.....	56,000*	68,000	50,000*	.....	18,000*	.....
Totals	2,744,000	2,672,000*	.....	72,000*	2,575,000	2,731,000*	156,000*	.....	.....

*Estimated.

CALIFORNIA

Month	—Production— 1928	1929	Increase	Decrease	—Shipments— 1928	1929	Increase	Decrease	Stocks at end of month
January	939,000	1,034,000	95,000	.....	1,111,000	1,033,000	.....	78,000	785,000
February	1,164,000	1,071,000	.....	93,000	1,016,000	984,000	.....	32,000	871,000
March	1,171,000	1,170,000	.....	1,000	1,082,000	1,148,000	66,000	.....	894,000
April	1,254,000	1,085,000	.....	169,000	1,184,000	1,058,000	.....	126,000	921,000
May	1,175,000	1,142,000	.....	33,000	1,235,000	1,066,000	.....	169,000	997,000
June	1,206,000	1,110,000	.....	96,000	1,255,000	1,113,000	.....	142,000	995,000
July	1,124,000	991,000	.....	133,000	1,192,000	994,000	.....	198,000	991,000
August	1,288,000	1,128,000	.....	160,000	1,294,000	1,123,000	.....	171,000	997,000
September	1,124,000	967,000	.....	157,000	1,102,000	1,023,000	.....	79,000	941,000
October	1,177,000	1,179,000	2,000	.....	1,257,000	1,183,000	.....	74,000	937,000
November	1,173,000	1,091,000	.....	82,000	1,103,000	1,038,000	.....	65,000	989,000
December	909,000	850,000*	.....	59,000*	914,000	900,000*	.....	14,000*	.....
Totals	13,704,000	12,818,000*	.....	886,000*	13,745,000	12,663,000*	.....	1,082,000*	.....

*Estimated.

OREGON AND WASHINGTON

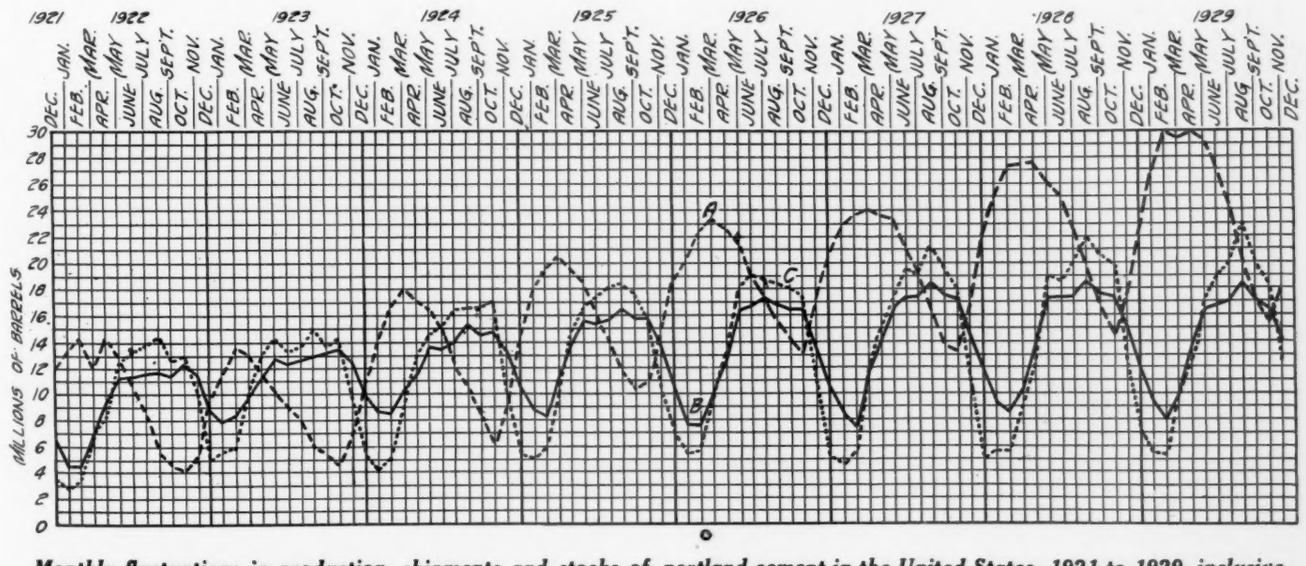
Month	—Production— 1928	1929	Increase	Decrease	—Shipments— 1928	1929	Increase	Decrease	Stocks at end of month
January	113,000	252,000	139,000	.....	118,000	140,000	22,000	.....	529,000
February	172,000	104,000	.....	68,000	175,000	100,000	.....	75,000	533,000
March	297,000	347,000	50,000	.....	222,000	292,000	70,000	.....	587,000
April	298,000	343,000	45,000	.....	312,000	330,000	18,000	.....	601,000
May	410,000	325,000	.....	85,000	413,000	297,000	.....	116,000	629,000
June	420,000	289,000	.....	131,000	440,000	327,000	.....	113,000	587,000
July	433,000	322,000	.....	111,000	469,000	362,000	.....	107,000	544,000
August	519,000	358,000	.....	161,000	551,000	409,000	.....	142,000	493,000
September	451,000	384,000	.....	67,000	410,000	407,000	.....	3,000	471,000
October	335,000	294,000	.....	41,000	362,000	331,000	.....	31,000	434,000
November	279,000	230,000	.....	49,000	305,000	217,000	.....	88,000	448,000
December	216,000	200,000*	.....	16,000*	167,000	130,000*	.....	37,000*	.....
Totals	3,943,000	3,448,000*	.....	495,000*	3,944,000	3,342,000*	.....	602,000*	.....

*Estimated.

Summary of Production 1928 and 1929 by Producing Districts

Districts	1928—Production—1929		Gain	Loss	%	Shipments 1928	1929	Gain	Loss	%	'28 No. Plants	'29 No. Plants	Stock at end of Nov.
Eastern Penn., N. J. and Md...	39,277,000	37,342,000*	.....	1,935,000*	—4.9	39,436,000	37,342,000*	.....	2,094,000*	—5.6	26	25	2,804,000
New York and Maine.....	11,481,000	11,277,000*	.....	204,000*	—1.8	11,353,000	11,727,000*	374,000*	.....	+3.3	12	12	935,000
Ohio, W. Penn. and W. Va.....	18,336,000	17,788,000*	.....	548,000*	—3.0	18,036,000	17,707,000*	.....	329,000*	—1.8	18	19	1,577,000
Michigan	13,900,000	13,469,000*	.....	431,000*	—3.1	14,041,000	13,444,000*	.....	597,000*	—4.3	15	14	1,255,000
Wis., Ill., Ind. and Ky.....	22,684,000	21,223,000*	.....	1,461,000*	—6.5	22,593,000	21,356,000*	.....	1,237,000*	—5.5	11	11	1,840,000
Va., Tenn., Ala., Ga., Fla., La.	15,936,000	13,598,000*	.....	2,338,000*	—14.7	15,732,000	13,995,000*	.....	1,737,000*	—11.0	19	19	1,066,000
E. Mo., Ia., Minn. and S. D...	16,687,000	16,004,000*	.....	683,000*	—4.1	16,503,000	16,023,000*	.....	480,000*	—2.9	12	12	1,260,000
W. Mo., Neb., Kan., Okla., Ark.	10,931,000	12,172,000*	1,241,000*	.....	+11.4	11,220,000	12,223,000*	1,003,000*	.....	+9.0	11	13	1,147,000
Texas	6,345,000	7,326,000*	981,000*	.....	+15.4	6,277,000	7,094,000*	817,000*	.....	+13.0	8	9	731,000
Colo., Mont., Utah, Wyo., Ida.	2,744,000	2,672,000*	.....	72,000*	—2.6	2,575,000	2,731,000*	156,000*	.....	+6.1	7	9	119,000
California.....	13,704,000	12,818,000*	.....	886,000*	—6.5	13,745,000	12,663,000*	.....	1,082,000*	—7.9	12	13	1,088,000
Oregon and Wash.....	3,943,000	3,488,000*	.....	495,000*	—12.5	3,944,000	3,342,000*	.....	602,000*	—15.3	8	9	251,000
U. S. A.....	175,968,000	169,137,000*	.....	6,831,000*	—3.9	175,455,000	169,647,000*	.....	5,808,000*	—3.3	159	165	14,073,000

*Estimated.



Monthly fluctuations in production, shipments and stocks of portland cement in the United States, 1921 to 1929, inclusive. (A) Stocks of finished portland cement at mills; (B) Production of finished portland cement; (C) Shipments of finished portland cement from mills

materially to demoralize the domestic industry in the East and South. The value of the cement imported the first 10 months of the year averaged $1.14 per bbl., compared with $1.33 per bbl., the average for the foreign cement imported in 1928.

Two-thirds of the portland cement imported (1,058,000 bbl.) in the first 10 months of the year came from Belgium and over 25% of this went to Massachusetts (mostly to Boston), where it formed a large percentage of all the cement used (255,000 bbl.). The average value of this cement imported into Massachusetts is given as $1.38 per bbl., with which price no American manufacturer can hope to compete. The largest importation of cement from Belgium to any one locality was to Los Angeles, Calif. (385,000 bbl. in first 10 months). It is assumed that most of this was in the form of clinker which was ground to cement at the new grinding mill of the Blue Diamond Co. The value of this is given as $213,400, or 55c. per bbl. New York City imported about 140,000 bbl. (in 10 months) of British cement, the average value of which was $1.53 per bbl. Most of the rest of the imported cement went to Southern ports, North and South Carolina taking over 100,000 bbl.

Protective Tariff

The portland cement industry presented a perfect case for a protective tariff, judged by the facts and logic on which protective tariffs have been granted other industries, both to the ways and means committee of the United States house of representatives and the finance committee of the senate. Up to this writing the cement schedule had not come before the senate investigating committee, and business opinion is about evenly divided, apparently, as to whether anything will ever be done with the projected tariff bill or not. If it is accepted by the senate as it passed the house it will give domestic cement manufacturers the benefit of a protective duty of approximately 30c. per bbl.

Significant Developments

The following tabulation of developments is not given as complete, except as to new plants, but merely to indicate the kind and character of the changes and improvements being made in the various mills of the industry—an index of the direction of progress.

Alpha. Completed installation of Cotrell electrical precipitation system for dust collection at Martin's Creek, Penn., plant. Reported to have installed and experimented with closed-circuit dry grinding at La Salle, Ill., plant, installed Sly dust collectors at Cementon, N. Y.

Arkansas. A new plant constructed by Arkansas Portland Cement Co., at Okay, Howard county, Ark., went into production in October. This mill uses the wet process, has one kiln 11 ft. 6 in. by 300 ft., two 8x7x40-ft. Compeb mills. A single Pennsylvania hammer mill does all the preliminary crushing. The Arkansas Portland Cement Co. is a subsidiary of the Ideal Cement Co., Denver Colo.; the new mill's estimated capacity is 700,000 bbl.; it is designed for two kilns.

Ash Grove. The Ash Grove Lime and Portland Cement Co., Kansas City, Mo., placed a new mill at Louisville, near Omaha, Neb., in production in May. This is a wet-process mill having two 260-ft. kilns. Both standard portland and high early strength portland ("Quickard") are manufactured. The estimated capacity is approximately 1,250,000 bbl.

Atlas. The Atlas Portland Cement Co., of Texas, a subsidiary of the Atlas Portland Cement Co., of New York, completed and placed in operation a new mill at Waco, Tex. It is notable as one of the two dry-process mills completed during the year and one of three dry-process mills built in the past several years. It incorporates all that is new in accurate proportioning and dry-blending. Both raw materials and finished cement are handled practically entirely with Fuller-Kinyon pumps. The kiln is 11x250 ft., with a 10x142-ft. cooler—one of the largest if not the largest cooler in the industry. A complete description of this plant was published in Rock Products, September 28, 1929. Its estimated capacity is 700,000 bbl. It went into production in August.

Bessemer. The Bessemer Securities Co., Youngstown, Ohio, holding company for the Bessemer Limestone and Cement Co., the Federal Portland Cement Co. and Peerless-Egyptian Cement Co., is reported to have purchased a site in Pittsburgh, Penn., for possible construction of a cement plant. The Bessemer Limestone and Cement Co. installed Oliver-United filters at its Bessemer, Penn., plant.

Blue Diamond. The Blue Diamond Co.,

The new 1,000,000-bbl. storage and packing plant at the La Salle, Ill., plant, Marquette Cement Manufacturing Co.

building supply dealer, producer of sand and gravel, manufacturer of lime and gypsum products, Los Angeles, Calif., became a factor in the local cement industry in June, when it started grinding imported Belgian cement clinker in what is reported to be one of the most up-to-date grinding units in the industry. Its estimated capacity (our estimate) is 500,000 bbl.

Calaveras. The Calaveras Cement Co. plant, Calaveras, Calif., described when new in ROCK PRODUCTS, January 22, 1927, was improved by the installation of additional storage facilities for both raw materials and clinker, and five additional silos for finished cement, giving a total cement storage of 140,000 bbl. (ROCK PRODUCTS, February 16).

Castalia. The Castalia Portland Cement Co., Castalia, Ohio, is reported to have installed "Norblo" dust-collecting equipment.

Consolidated. The Consolidated Cement Co., Cement City, Mich., is reported to have installed Oliver-United filters for slurry dewatering and to have made other improvements. Sly dust collectors were installed at the Mildred, Kan., mill.

Cowell. The Cowell Portland Cement Co., Cowell, Calif., is reported to have installed "Norblo" dust-collecting equipment in its packhouse.

Crescent. The Crescent Portland Cement Co. was sold in May to the Medusa Portland Cement Co., Cleveland, Ohio.

Davison. The Davison Coke and Iron Co., Pittsburgh, Penn., owners of the Basic Products Co. cement plant, Kenova, W. Va., built and placed in production in September a new mill on Neville Island, below Pittsburgh, Penn. This mill is chiefly notable because it was designed to utilize byproducts of steel and coke-oven operations—slag as raw material and coke-oven gas for fuel. The kilns are wet process, 10x175 ft., and are preceded by Oliver-United slurry filters. Waste-heat boilers are part of the equipment. Estimated capacity is 1,000.000 bbl.

Dewey. The Dewey Portland Cement Co. is making extensive changes and improvements at its Davenport, Iowa, mill, including the installation of Oliver-United slurry filters, a clay wash mill, closed-circuit grinding equipment on the raw end. and Sly dust collectors. It was announced in September that the company would build a river terminal for water transportation on the Mississippi river.

Florida. The Florida Portland Cement Co., Tampa, Fla., opened a new clay pit near Brooksville, Fla.

Ford. The Ford Motor Co.'s cement mill at River Rouge, Mich., was further improved by the installation of kiln-stack filters, a mechanical type dust arrestor made by the Dust Recovery and Conveying Co.

Hawkeye. The Hawkeye Portland Cement Co., Earlham, Iowa, is reported to be planning extensive additions and improvements to its crushing plant in order to increase its commercial crushed-stone business.

Hercules. The Hercules Cement Corp., Philadelphia, Penn., developed a special railway car for bulk cement shipments.

Huron. The Huron Portland Cement Co., Detroit, Mich., is reported to have installed a new kiln and auxiliary equipment, including two EdgeMoor waste-heat boilers, at its Alpena, Mich., mill. This company is also reported to have purchased a site on the waterfront at Toledo, Ohio, for a packing plant.

Idaho. The Idaho Portland Co., Pocatello, Ida., completed and placed in production a new mill at Inkom, Ida., in June. This mill uses the wet process with the simplest possible layout and equipment. It has one 10x200-ft. kiln and 7x30-ft. Compeb mills. Estimated capacity is 500,000 bbl.

International. The International Cement Corp., New York City, changed the names of all its American subsidiary companies to "Lone Star," the brand name. It is reported to have extended the manufacture of "Incor" quick-hardening portland cement to practically all its plants.

Keystone. The Keystone Portland Cement Co., Bath, Penn., doubled capacity of its mill by addition of two kilns and auxiliary equipment, including a large size Pennsylvania hammer mill. Capacity increased approximately 1,000,000 bbl.

Lawrence. The Lawrence Portland Cement Co., Thomaston, Me., installed Oliver-United slurry filters.

Lehigh. The Lehigh Portland Cement Co., Allentown, Penn., among many plant changes, doubled the capacity of its Sandt's Eddy plant near Easton, Penn., by addition of two 11x10x160-ft. Taylor kilns and auxiliary equipment, increasing the capacity from 1,000,000 to 2,000,000 bbl. This company is reported to have adopted dry closed circuit grinding extensively.

Lone Star. The Lone Star Cement Co., New York, Hudson, N. Y., subsidiary of the International Cement Corp., installed Oliver-United slurry filters and additional dust-collecting equipment.

The Lone Star Cement Co., Texas, added a new stock house to its Dallas mill, and is reported to have improved its crushing plant by installing the largest Dixie hammer mill yet made and additional Sly dust collectors.

The Lone Star Cement Co., Virginia, built a pack house with 60,000-bbl. storage silos on the waterfront of Washington, D. C., and put in service a self-unloading, bulk cement carrier between its Norfolk, Va., mill and Washington, D. C. (ROCK PRODUCTS, May 11 and October 12, 1929).

Manitowoc. The Manitowoc Portland Cement Co., Manitowoc, Wis., was merged with the Medusa Portland Cement Co.,

Another view of the new storage at the Marquette company's La Salle mill. This installation is the largest group of cement silos in the world

Cleveland, Ohio, and in co-operation with the Petoskey Portland Cement Co. built a waterfront packing plant at Chicago, Ill.

Marquette. The Marquette Cement Manufacturing Co., Chicago, Ill., completed in February its new dry-process, 2,000,000-bbl. mill at La Salle, Ill. This is reported to have all the latest equipment for dry blending. In connection with this mill and its older operation at La Salle, the Marquette company built a 1,000,000-bbl. storage and pack house—undoubtedly the largest group of cement silos and one of the largest cement packing plants in the world. There are two rows of silos, each silo, or bin, being 46-ft. inside diameter by 100 ft. high. The silos are in groups of 10 each, with a bag house between, about 25 ft. wide. There are two packing plants, called "island packing houses," 34 ft. square, in which are four Bates 3-tube packers each—eight packers in all. The cement is pumped from the mills to the silos, a distance of approximately 1000 ft., by Fuller-Kinyon pumps. A portable Fuller-Kinyon pump is located under each row of five silos, four in all, and these take the cement from the silos and pump it to the two island pack houses. Each two packing machines is served by a railway track. The silos and pack houses were built by the Macdonald Engineering Co.

The Marquette company is reported to have completed improvements to its Cape Girardeau, Mo., mill which about doubled its capacity. This company also completed a packing plant at Memphis, Tenn., and began bulk transportation of cement from Cape Girardeau in a fleet of specially designed, self-unloading steel barges (ROCK PRODUCTS, September 28, 1929). A similar packing plant is reported under construction for the company on the waterfront of St. Louis, to which bulk cement will also be brought by barge.

Medusa. The Sandusky Cement Co., Cleveland, Ohio, purchased the Crescent Portland Cement Co., Wampum, Penn. The

A recently completed waterfront cement packing plant

Sandusky Cement Co. changed its name to the Medusa Portland Cement Co., the name of its brand, and subsequently merged under that name with the Newago Portland Cement Co. and the Manitowoc Portland Cement Co. Development of waterfront property at Charlevoix, Mich., was continued, and the intention to ultimately build a mill there was officially announced.

Monolith. The Monolith Portland Midwest Co., Laramie, Wyo., completed and placed in production in May a new wet-process mill near Laramie (described in Rock Products, July 6, 1929, and August 31, 1929). This plant has a single 11 ft. 3 in. by 10 ft. by 343-ft. Unax kiln, and can make either standard portland or a special plastic cement. Its estimated capacity is 600,000 bbl.

The Monolith Portland Cement Co., Los Angeles, Calif., completed improvements and rebuilding of its Monolith, Calif., mill which make it practically a new plant. It also changed from open quarrying to underground mining of limestone.

Michigan. The state cement plant at Chelsea, operated by convict labor, added new storage facilities.

National. The National Portland Cement Co., Houston, Tex., is reported to be building a single kiln plant at Chubbock, Calif., in San Bernardino county.

Newago. The Newago Portland Cement Co., Newago, Mich., was merged with the Medusa Portland Cement Co.

North American. The North American Cement Corp., Albany, N. Y., is reported to have increased the quarry holdings of its Catskill, N. Y., plant.

Northwestern States. The Northwestern States Portland Cement Co., Mason City, Iowa, is reported to have operated its quarry at its Gilmore City plant for the production of commercial crushed stone.

Olympic. The Olympic Portland Cement Co., Bellingham, Wash., added storage silos and made other improvements at its mill. This company also developed a new quarry and built a new crushing plant (described in Rock Products, November 23).

Pacific Coast. The Pacific Coast Cement Co., Seattle, Wash., began shipping cement from its new mill in January (described in Rock Products, December 7, 1929). This is a two-kiln wet-process plant, having an annual capacity of 1,250,000 bbl.

Peerless-Egyptian. The Peerless-Egyptian Cement Co., owned by the Bessemer Securities Corp., is reported to have spent $125,000 on improvements to its mill at Port Huron. This company is also said to be contemplating the construction of silos and packing plant on the waterfront at Toledo, Ohio.

Penn.-Dixie. The Pennsylvania-Dixie Cement Corp. closed its Kingsport, Tenn., plant in February and is now engaged in rebuilding it and eventually converting the mill to the wet process.

Petoskey. The Petoskey Portland Cement Co., Petoskey, Mich., installed Oliver-United slurry filters. This company also completed packing plants on the waterfronts of Milwaukee and Detroit, and put in commission a lake bulk cement carrier, equipped with Fuller-Kinyon pumps for self-unloading. In co-operation with the Manitowoc, Wis., plant of the Medusa Portland Cement Co., the Petoskey company built a waterfront packing plant at Chicago, Ill.

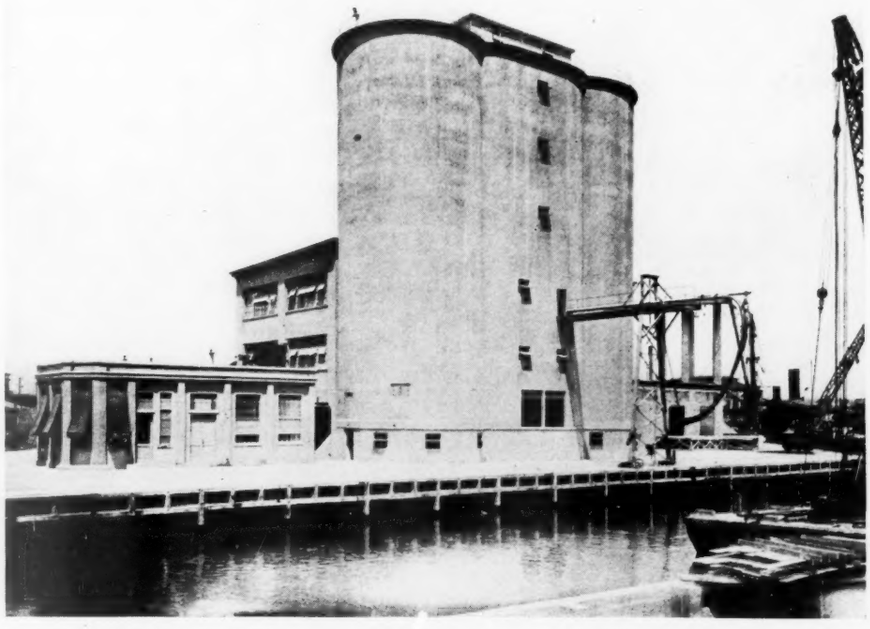
Republic. The Republic Portland Cement Co., San Antonio, Tex., completed and placed in production a new wet-process plant in June (described in Rock Products, October 26, 1929). There are two 11x250-ft. kilns. The rated capacity is 1,250,000 bbl.

Riverside. The Riverside Cement Co., Riverside, Calif., is changing over from open-pit to underground mining of limestone.

San Antonio. The San Antonio Portland Cement Co., San Antonio, Tex., completed a new pack house, one of the most modern in the industry.

Signal Mountain. The Signal Mountain Portland Cement Co., Chattanooga, Tenn., moved its offices into town and established a research laboratory.

Southwestern. The Southwestern Portland Cement Co., Los Angeles, Calif., installed Oliver-United slurry filters at its Osborne, Ohio, mill. Improvements at the El Paso, Tex., mill were completed, including a new power plant, totaling $250,000. Capacity increased 500 bbl. per day, 200,000 bbl. per year.



Waterfront cement packing plants and storage facilities were one of the developments in 1929

Standard. The Standard Portland Cement Co., Painesville, Ohio, installed Oliver-United slurry filters, Norblo and Sly dust collectors. Other improvements included an 8x42-ft. Allis-Chalmers Compeb mill, equipped with Timken roller bearings and forced lubrication, and a Traylor single-roll crusher.

Superior. The Wellston Iron Furnace Co., owners of the Superior portland cement plant, Superior, Ohio, began the manufacture of two new special cements, "Sticktite," a waterproof stucco cement, and "Fast-Hard," a high early strength product. This mill was also equipped with Sturtevant closed-circuit dry grinding, air-separation machinery.

Three Forks. The Three Forks Portland Cement Co., Three Forks, Mont., a subsidiary of the Ideal Cement Co., Denver, Colo., completed improvements and reopened its mill after several years' shutdown.

Trinity. The Trinity Portland Cement Co., Dallas, Tex., installed Norblo dust collectors on its finish mills at the Houston plant and installed Sly dust collectors at the Fort Worth mill.

Universal. The Universal Portland Cement Co., Chicago, Ill., began bulk shipments of cement by water from its Buffington, Ind., plant. Extensive changes and improvements are contemplated at Buffington, it is reported. This company, as a subsidiary of the United States Steel Corp., will absorb the Atlas Portland Cement Co. operations, recently purchased by the Steel corporation through an exchange of stock.

Valley Forge. The Valley Forge Cement Co., West Conshohocken, Penn., completed a new laboratory, modern in every detail.

Vulcanite. The Vulcanite Portland Cement Co., Philadelphia, Penn., moved its main sales office to New York City.

Wabash. The Wabash Portland Cement Co., Detroit, Mich., completed improvements to the power house of its Osborn, Ohio, plant.

West Penn. The West Penn Cement Co., West Winfield, Penn., built new silos and made crushing-plant improvements, noted elsewhere in the review of the crushed-stone industry.

Wolverine. The Wolverine Portland Cement Co., Coldwater, Mich., is installing a new 10x300-ft. Allis-Chalmers kiln of the latest improved type. Other improvements are being made, including a slurry filter installation, it is reported.

Summary of New Plants

	Barrels
January—Pacific Coast	1,250,000
February—Marquette	2,000,000
May—Ash Grove	1,250,000
Monolith Midwest	700,000
June—Republic	1,250,000
Idaho	500,000
Blue Diamond	500,000
August—Atlas	700,000
September—Arkansas	700,000
Davison	1,000,000
Total	9,850,000

It will be recalled that the six new plants completed in 1928 contributed but half this tonnage; so it is evident that portland cement manufacturers were optimistic at the beginning of the year, if not at its close.

Projected Plants

One might conclude from the foregoing that investors and promoters would declare a moratorium on cement-plant building for the time being, but such is not the case, for we have the following record of new projects in various stages of promotion or construction:

Alta. The Alta Cement Co. secured options on 500 acres of land at Volcano, Calif., early in the year.

Atlas. The Atlas Portland Cement Co., New York City, was recently reported to be projecting a new mill at Rochester, Minn.

American. The American Portland Cement Co., Little Rock, Ark., is reported to be slowly assembling machinery and equipment.

Columbia. The Columbia Cement Co. was organized in October to build a $2,000,000 mill at San Diego, Calif., with a capacity of 3000 bbl. per day. The plant site is said to have been selected at National City. Fred A. Ballin, formerly of the Monolith Portland Cement Co., heads the organization.

Kittanning. The Kittanning Limestone Co., Kittanning, Penn., changed its name in June to the Kittanning Cement and Limestone Co., but nothing further has been announced.

Kentucky. The Kentucky Cement Corp., Frankfort, Ky., project is reported dormant for the time being.

Los Angeles. The Los Angeles Portland Cement Corp. was recently incorporated in Delaware for $1,600,000. This is the project of the Santa Monica Mountain Park Co., Los Angeles, Calif., of which Alphonso E. Bell is president, to build a cement plant at Santa Monica with a limestone quarry in Beverly Hills. After creating a tremendous amount of hostile publicity, it seems possible of accomplishment, according to latest reports.

Mathieson Alkali Works. It is rumored that this company has purchased equipment for a two-kiln plant at Saltville, Va.

Metropolitan. Reported that the Metropolitan Cement Corp., 300 Madison Ave., New York City, has a new mill under construction near New Brunswick, N. J.

Mississippi. The National Portland Cement Co., Houston, Tex., which is constructing a plant at Chubbock, Calif., is reported contemplating a $1,000,000 plant at Vicksburg, Miss. It is reported a waterfront site has already been acquired.

Monolith. The project of the Monolith Portland Gulf Co., Los Angeles, Calif., to build a mill near Corpus Christi, Tex., is reported rather dormant at the present time.

North Carolina. The project to erect a cement mill at New Bern, N. C., which was started about two years ago, is said to be still alive.

Paramount. The Paramount Portland Cement Co., Los Angeles, Calif., has a project to build a $2,800,000 mill at Torrance, Calif.

Port Stockton. The Port Stockton Cement Co., San Francisco, Calif., has incorporated under the laws of Nevada, has a project for a mill near Stockton, Calif., to cost $1,750,000.

Riverside. Rumors of a project to build a cement mill at Phoenix, Ariz., were revived by the incorporation of the Riverside Portland Cement Co., San Francisco, in Arizona.

San José. The project of the Guadalupe Portland Cement Co. to build a cement mill at San José, Calif., has been revived during 1929, it is reported.

Tulsa. Surveys have been made with a view to the promotion of a cement mill at Tulsa, Okla.

It is, of course, evident that in view of the present condition of the industry, new mills can hope to get business only by serving a restricted local territory, or by making a better or cheaper product. In view of development taking place at many so-called old plants, it is likely to become increasingly difficult to accomplish the latter.

Canadian Developments

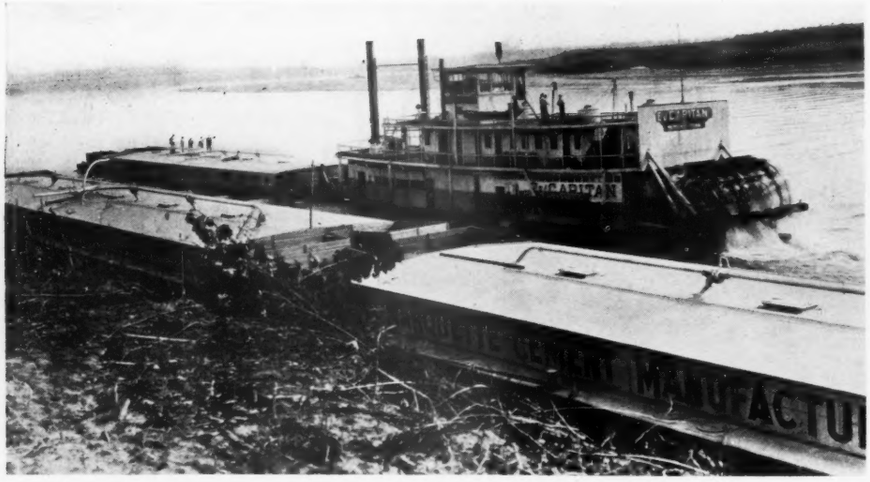
British Columbia. The British Columbia Cement Co. is reported to have reopened its Todd Inlet mill after several years' shutdown. This company also built a concrete wharf on Texandra Island for loading out limestone.

Canada. The Canada Cement Co., Ltd., converted its Hull, Que., plant from dry to wet process. F. L. Smidth and Co. were the engineers and the kiln (Traylor) installed is the largest in North America—365 ft. long, 11 ft. 3 in. and 10 ft. in diameter. The company has recently let contracts to F. L. Smidth and Co. for conversion of its No. 1 mill at Montreal from dry to wet process. This is the largest mill the company operates. The Canada Cement Co. also entered extensively into bulk cement shipments from its Montreal plant by water to Quebec, Halifax and St. John, where packing plants have been or are being built. It is also reported that the company will build a packing plant at Toronto, Ont. In September the company put into commission a bulk carrier—a 258-ft. steamship, the *Bulkarier*. The Canada Cement Co. during the year is reported to have acquired control of the National Cement Co., Ltd., Montreal.

Maritime. The Maritime Portland Cement Co., Brookville, N. B., was incorporated in January for $1,000,000.

St. Mary's. The St. Mary's Cement Co., St. Mary's, Ont., is reported to have recently started work on a plant addition.

Vancouver, Seattle, Wash., promoters are reported to be contemplating the erection of a cement mill of 300,000-bbl. capacity at Vancouver, B. C.



Bulk cement carriers for water transportation between the mill and waterfront packing plant

Rest of the World

The year 1929 was a year of active cement-plant building all over the world. Several new projects were launched in Great Britain. There was considerable rebuilding and reconstruction in South America. In Holland, the first cement mill in its history was completed—the Erste Nederlandische Cement Industrie, at Maastricht, Netherlands. It is one of the largest new cement mills in Europe—6000 bbl. per day—and was designed and engineered by G. Polysius, A.-G. Dessau, Germany, the parent company of the Polysius Corp., Bethlehem, Penn. A description will appear in an early issue.

Toward the end of the year it was announced that the Russian government had let contracts to an American company, the Macdonald Engineering Co., for building four new cement mills in Russia and Siberia.

Technical and Economic Progress

From a mechanical point of view the year 1929 was marked by two outstanding developments—the wide interest and extensive adoption of closed-circuit grinding, both wet and dry, but more particularly dry, for reasons noted farther on, and the growing use of slurry filters. From an economic point of view the shipment of cement by bulk carrier is an outstanding development. The self-unloading, sea-going, bulk-cement carrier is not a recent development, since ships of that type have been in use on the Great Lakes for several years by one or two manufacturers. The year 1929 did mark the development of a new type bulk carrier using one, or in the case of the Canada Cement Co. carrier, two Sauerman scraper buckets in tunnels, for removing the cargoes, in place of belt conveyors, previously used for the same purpose, or more recently Fuller-Kinyon pumps. The year 1929 saw boats and barges of a more or less similar type adopted for bulk carriers on the East Coast and on the Mississippi and Ohio rivers, as well as on the Great Lakes. Also during the year the Hercules Cement Corp. developed a railway bulk carrier, described elsewhere in this issue. The economic effect of these developments on the industry has been important and promises to be more so. It has led to the building of packing plants in cities far removed from the manufacturing plant and given several mills fortunately situated on waterfronts many of the advantages of mills located in the midst of big consuming markets, such as truck deliveries direct from packing plant to job. It has decreased the necessity for new mills in such locations, if not the inducements.

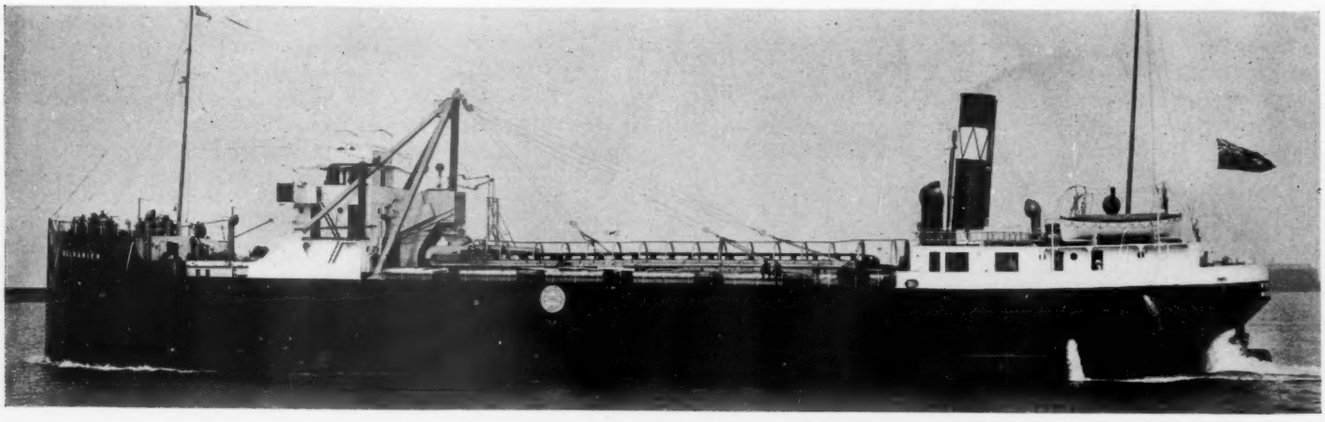
Wet and Dry Issue to the Fore Again

For nearly two years the Portland Cement Association has been conducting research work on closed-circuit grinding in collaboration with the United States Bureau of Mines at the Experiment Station at the University of Minnesota, and research work on particle size at the United States Bureau of Standards, Washington, D. C. While the results of these researches have not been made public except to members of the Portland Cement Association, enough is known to predict that they are almost revolutionary.

While closed-circuit wet grinding had proved its efficiency and economy in metallurgy, and it only remained to convince portland cement manufacturers, the same was not true of closed-circuit dry grinding. The simultaneous development of both reopens anew the controversy of dry vs. wet process. The successful application of both, so far as the portland cement industry is concerned, hinged on the determination of the best particle size for the chemical reaction in a rotary kiln, and this appears to have been more or less definitely established, although it may vary a bit with the materials and conditions.

During the last few years, with the increasing demand for quicker hardening cement and consequently the more careful proportioning of raw materials, the wet process, with very long kilns and various devices for increasing heat efficiency, such as chains and slurry filters, has been by far the more popular of the two processes. In addition to more accurate preparation and easier control, the greater economy of wet grinding has swung the balance in favor of the wet process. Still greater economy in grinding, using a closed-circuit with slurry thickers, and in burning by use of slurry filters, or chains, have still more increased the favor of the wet process. For example, the wet-process Ford plant, using slurry filters and other heat conservation methods, reduced coal consumption for an entire month to an average of less than 72 lb. per bbl. (coal 14,000 B.t.u.).

Now, it is reported, the use of air separators in closed circuit with dry raw mills and



The "Bulkarier," put in service by the Canada Cement Co., Ltd., to carry bulk cement between Montreal plants and Quebec, Halifax and St. John packing plants

accurate control of the size of particle removed, has almost revolutionized the relationship of the two processes. Some of the older dry mills, which seemed on the verge of becoming obsolete, have accomplished truly remarkable results in improved quality of product and in increased capacity of both grinding units and kilns. Of course, air separators, especially on the finish end, are by no means new to the cement industry, but the present type and adaptation of them are new. In the opinion of some of the most experienced cement manufacturers in the industry, this new closed-circuit dry grinding and use of particles of raw materials of the correct size for the product wanted, with up-to-date methods of dry blending, is going to be a life saver for many older dry mills.

Most of the new machinery installed in 1929 presents no striking change over that of the year previous. The Canada Cement Co. has adopted very large kilns—the one at Hull being 365 ft. long—following European practice, where fuel economy is a very important consideration. Two-stage grinding still has many advocates, as witnessed by new installations with such preliminary grinders as the Hercules mill. The use of large three-compartment mills continued, and improvements have been made in large size roller bearings and lubrication.

The Product

The most notable development in the course of the year was the first step by American Society for Testing Materials toward recognizing more than one standard portland cement. At the Atlantic City convention in June the society's cement committee made "tentative" revisions in its specification for portland cement by recognizing two sets of strength requirements, so as to draw a distinction between ordinary portland cement and high early strength portland cement. The committee is now planning to revise the standard specifications for portland cement (C 9-26) changing the minimum tensile strength requirements at 7 days from 225 lb. per sq. in. to 275 lb. per sq. in. and the minimum tensile strength at 28 days from 325 lb. per sq. in. to 350 lb. per sq. in. A special sub-committee has been appointed to study the question of limiting the lime content by the use of the molecular ratio of lime to silica, alumina and iron. The committee is preparing new tentative specifications for high-early-strength portland cement, using the present specifications for portland cement as a basis. Instead of the present requirements of 2% for sulphuric anhydride, however, it is proposed to place this requirement at 2½% in the high-early-strength specifications. It is further proposed that the minimum tensile strength at 1 day shall be 275 lb. per sq. in. and at 3 days, 375 lb. per sq. in. The provision is also included that at the option of the purchaser a 28-day test may be required, in which case the average tensile strength at 28 days shall be higher than the strength obtained at 3 days. The proposed new tentative specifications are also being balloted upon in the committee. New proposed specifications for masonry cement and for natural cement are being recommended for acceptance as tentative. The question of variations in the analysis of standard Ottawa sand when tested by different sieves has been referred to the sub-committee on fineness.

In other words, everything points to a universal demand for an early hardening cement, as compared with much that has been marketed in the past. The economy of early hardening cement to the constructor of nearly all structures, in form work, labor, time, etc., is so great that apparently the time is not far distant when there will be little market in the average case for anything but quick-hardening cement.

Considerable progress was made during the year in applying some of the new knowledge of the constitution of portland cement; but, as P. H. Bates has pointed out in a report to the American Concrete Institute,* we are a very long way from a "standard" cement or in, other words, a cement with anything like standard or uniform composition, or properties such as early strength, late strength, workability, etc. Whether the result of all this research and such frank criticisms as Mr. Bates' will be an attempt to make portland cement of uniform and standard composition and properties, or the differentiation of cements and the capitalization of any special qualities or virtues some may have and others not, remains to be seen. In any event, our knowledge of portland cement is increasing faster than at any previous period in its history; and that's a good thing, no matter what the immediate result may be.

**Journal of the American Concrete Institute*, December, 1929.

Natural Cements in 1929

JUDGING from the new plants that were built during the past year there was an awakening in the building materials industry to the possibilities of special mason's cements and stuccos, and to the possibilities of adopting modern methods of production for one of the oldest cements manufactured in North America. Natural cement was first made in the United States during Erie Canal building days and used in such structures as the foundations of Brooklyn bridge, the Statue of Liberty, so that its permanent nature and strength is beyond question. Such hydraulic cements include natural, puzzolan cements and artificial mixtures with portland cement.

In 1928 there were 11 plants producing hydraulic cements, according to the United States Bureau of Mines. There was one plant each in Alabama, Illinois, Indiana, Kansas, Kentucky, Ohio and Pennsylvania and two plants each in Minnesota and New York.

New Plant at Rosendale

During 1929 there was added to the above number of plants, one in New York, that of the Century Cement Corp., with a new plant at Rosendale, one in Wisconsin and one in Ohio. In Wisconsin the Western Lime and Cement Co. was reported to have entered the field with a natural cement or hydraulic lime plant, and in Ohio, the Marble Cliff Quarries Co. The Midwest Crushed Stone Co. started manufacturing a mason's cement using portland cement, limestone dust and another ingredient to supply the necessary plasticity.

One of the largest and best equipped plants ever built for the production of natural cement was placed in operation at Rosendale, N. Y., by the Century Cement Corp. The argillaceous limestone used as the raw material for this cement is burned in a battery of eight vertical shaft kilns of the mixed-feed type, using anthracite buckwheat coal as fuel.

The limestone is secured from two separate ledges, white rock and dark stone, which are burned separately and mixed for making the cement. Room and pillar methods are used for securing the raw material.

After burning and crushing the clinker is elevated to the main grinding mill, located above the plant, by an aerial tramway, where mixing for blending is done by means of three Schaffer poidometers. Chemicals, to control the set, are added at this point. Raymond mills, followed by tube-mill grinding, is the practice for fine grinding in conjunction with Hum-mer screens for removal of any oversize. Hum-mer screens are also used to remove any lumpy or caked material prior to sacking. Soule and Zepp, Baltimore, Md., were consulting engineers on the design and construction of this new plant (a more complete description of which will follow in an early number of Rock Products).

The mill has a capacity of 1000 bbl. per day, with provision for increasing the capacity to 3000 bbl.

The Western Lime and Cement Co., at their Hicliff, Wis., plant started manufacturing a natural cement early in 1929 that has been very favorably received throughout Wisconsin and Minnesota points. The company did not build a new plant, but altered its old three-kiln (shaft type) plant for this venture.

The Bessemer Limestone Cement Corp., Youngstown, Ohio, is reported to be about to manufacture a special masonry mortar having high early strength characteristics and will use slag screenings as one of its ingredients.

Crushed Stone in 1929

FROM AN APPRAISAL of statistical data on the crushed stone industry in 1929 we are of the opinion that the total production for the year was about 3% under that for 1928 and that prices were substantially the same (possibly a little less) as for 1928 when an average price of $1.03 per ton was received. This opinion is based on compilation of answers to questionnaires, car loading reports, United States Department of Commerce data, on editorial observation in which members of the staff of ROCK PRODUCTS visited practically every state in the Union, Canada, Mexico and Cuba and from extensive correspondence.

South Atlantic States

Here and there throughout the United States there were notable exceptions to this statement, for some districts showed marked changes in price and production statistics compared with 1928, changes that were governed by more or less local conditions. Even were we to group certain sections such as the South Atlantic States under one head, in a summary of conditions, they would be misleading, as Florida, for instance, started off the year with very bright prospects that later were dimmed considerably due to unsettled economic conditions. On the other hand, Georgia, its neighboring state, and South Carolina, passed through a very favorable year as far as the crushed stone industry was concerned, mainly due to the awakening of those states to the needs of highways. Georgia had a $75,000,000 highway bond issue up for approval which failed to pass, but South Carolina passed its bill for a similar amount. These states are in a favorable position in so far as competition from gravel producers is concerned, as that commodity is not much in evidence. There was a marked increase in the number of plants built in these states during the year, although the number of new companies entering the field was not as large, there being more of a trend towards older and well organized companies in North Carolina and other localities to extend operations southward to take advantage of expanding markets in those two states. Highway construction in North Carolina apparently has passed its peak, or that state had a serious overproduction, or may be both. Crushed stone production in south Georgia is confined principally to the Ocala limestones, while in the northern part of the state and the Carolinas stone production is confined to granites. Again, to show the probabilities of an improper appraisal of conditions when grouped in sections that include several states, Virginia's crushed stone output was confined mostly to railroad ballast, apparently, and that mostly along the North Carolina-Virginia boundary line. This was due to a falling off in construction and competition from sand and gravel.

New plants completed in this, the South Atlantic group, were those of the Southern Lime Products Co., Cordele, Ga., 30 to 40 cars capacity per day, representing an investment of about $200,000; the Consolidated Quarries Corp., Lithonia, Ga., one of the most modern, large capacity, dry screening granite-crushing plants in the granite areas; the Ocala Lime Rock Corp., Ocala, Fla., completed a 2000-ton per day lime-rock, road material, crushing plant near Haile, Fla. These are only a few of the plants built in that section; others will be mentioned later under the subhead of "Other Developments."

North Atlantic States

Throughout the Eastern and New England States there was a slight (about 4%) decrease in volume and a slight drop in price; New Jersey producers reported greater price recessions than any of the states in that group. All reported prospects of a better year in 1930, as to volume, with the exceptions of New Jersey, Massachusetts and Vermont. These report expected drops in tonnage. Prices in 1930 are expected to be held at their present level. All the states reported increases in highway construction programs for 1930 except Vermont, which indicates a slight decrease in paved mileage. There was no change in gas tax in New York, Massachusetts and Rhode Island, all which have a 2 c. per gal. tax. Pennsylvania has increased its tax to 4 c., to be effective until July 1, 1930, when it drops back to 3 c.

East Central States

Apparently there was no reduction in volume or price in Michigan, with indications that 1930 will be about the same as 1929. This state expects an increase in revenue due to a 15% increase in automobile registration. During 1930 there will be built about 150 miles more of concrete highways than were built in 1929. Illinois suffered reductions in both volume and prices and unless the situation corrects itself conditions probably will be worse in 1930. Some producers expressed hope that the new gas tax would materially improve conditions during 1930. Ohio producers reported about the same tonnage, but serious reductions in price, apparently about 10%; and there are only 300 miles of concrete highway work in prospect for 1930. Indiana producers reported no changes in 1929 and none are looked for in 1930 so far as prices and volume are concerned.

Minnesota and Wisconsin producers report a falling off in volume and prices as do the other states in that section.

Far Western States

The Rocky Mountain States producers reported a considerable road construction program with prices normal. Washington state will spend about $10,000,000 for highways during 1930. In the Northwest generally there were reductions in volume and prices, but California operators reported a fair volume, about the same as 1928, with no change in prices. The outlook for 1930 indicates an increase of about 10%.

South Central States

After a review of all the sources of information it is heartening to study the statistics and reports for the Southern States in and bordering the Mississippi Valley. All reported slight increases in volume except Texas, where producers reported about 6% less for 1929 than for 1928. Kansas producers reported the maximum increase in volume (10%). Alabama producers also reported a similar increase. Prices dropped in all sections of this territory except in Kentucky, where increases were reported. It is interesting to note in passing that Kentucky was the scene of a recent merger of considerable significance to the crushed stone industry.

Prospects for 1930 in the South Central States are all very good, with the exception of Mississippi, a state of minor importance as a crushed-stone producer; practically no state highway work is contemplated there in 1930. All these states reported, with the one exception of Mississippi, practically a 100% increase in highway construction for 1930. The gas tax is popular in the South. Alabama increased its tax from 3 c. to 4 c. in 1928, as did Oklahoma and Texas. Missouri drew on its $75,000,000 bond issue passed in 1928 for the first time during 1929. The $175,000,000 bond issue proposed in Texas failed to pass the legislature by a narrow margin, and the projected $150,000,000 bond issue of Oklahoma also failed in its house of representatives. However, Texas reports $30,000,000 probably will be available for highway work in 1930.

Technical Trends

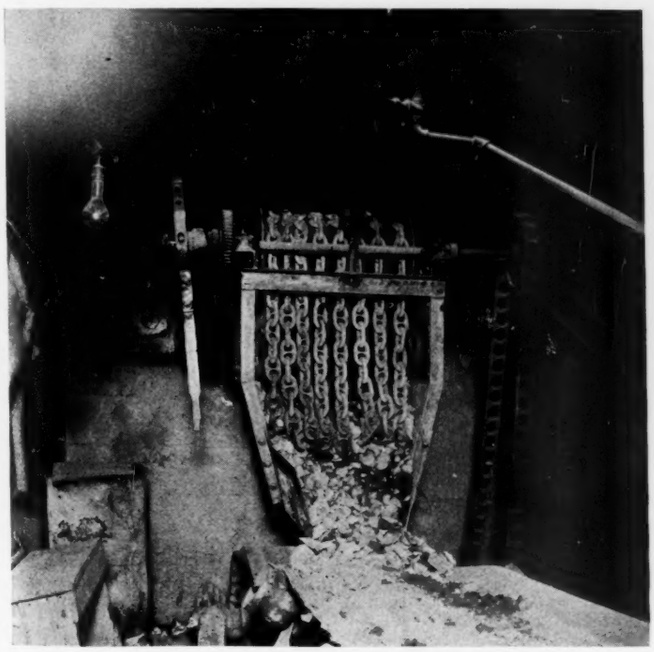
In the operation of quarries installations of larger and more powerful shovels with a leaning towards electric drives was everywhere apparent. Shovels on crawler treads have practically entirely superseded the older railroad mounted types except on some of the older operations. These are, however, being rapidly replaced with electric, gas-electric or Diesel-driven shovels. The widespread attempt to effect economics in powder cost is marked by the number of "biggest shots" reported, these in most cases were loaded under the direct supervision of

powder company representatives and gave substantial returns in savings of dollars and cents. At least one large crushing plant built during 1929 used aerial tramway transportation, a method long popular abroad.

Liquid oxygen as an explosive found extended use in the Chicago territory, where several quarries are supplied from a strategetically located plant. This new development in quarry blasting and servicing practice for 1929 was described in the April 13 issue of Rock Products. Thus far L. O. X. (liquid oxygen explosive) has been more extensively adopted by strip coal mine operators than by commercial crushed stone producers.

The year saw the introduction of Diesel-driven locomotives of narrow gage as well as the use of 10-yd. Western type cars on 36-in. gage track. Previous to this year large capacity cars were practically confined to standard gage tracks, and this development points the way to more flexible and cheaper track for quarry operation while still retaining the advantage of large capacity cars.

Many producers changed from industrial railway transportation to motor trucks, and those already using motor trucks are apparently well satisfied with their performance, and in several cases have purchased additional trucking equipment. There is a distinct movement toward larger trucks; some installed in 1929 carry 20 tons on six wheels. The Sunbeam Quarries Co., Claremont, Ky., which recently started operation, is using Athey trucks, a steel body mounted on crawler treads and powered by Caterpillar tractors. Truck transportation has been confined practically to hauls of less than 1000 ft. At many quarries having industrial track haulage motor trucks are used for disposal of strippings. At least two crushed-stone operators who mine their material are using motor trucks for delivery of stone from the mine to the crushing plant. One is the Newcastle Lime and Stone Co., Dunbar, Penn., and the other operates in southern Illinois.

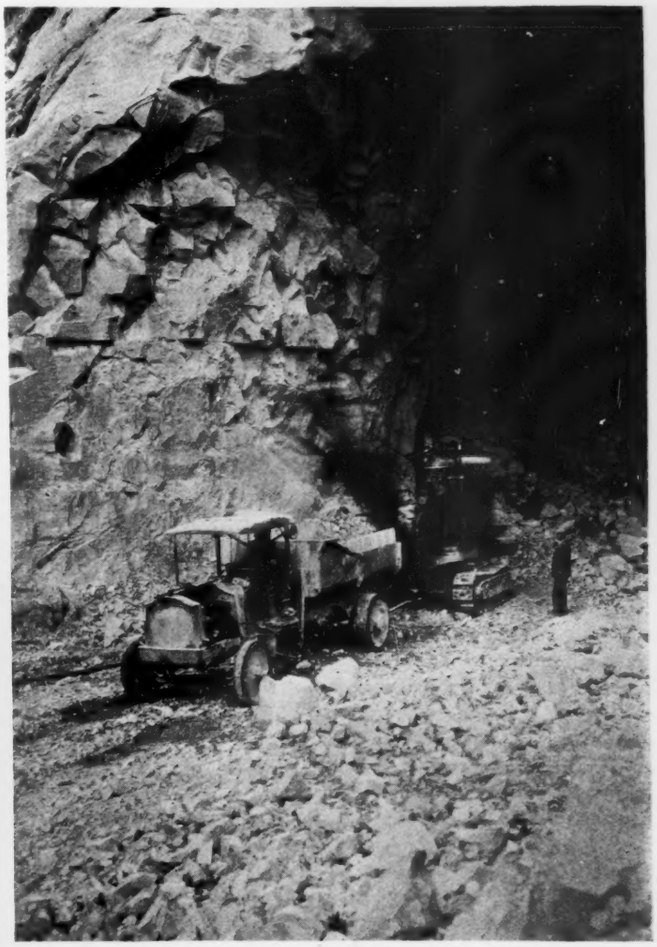


Chain feeders were a 1929 development

Changing from quarrying to mining for crushed stone aggregate has been noted in several instances, and in the lime and portland cement industries there has been a decided trend towards underground mining. Two large operators in that field on the West Coast are using glory-hole methods, and one is planning on shrinkage stopping methods, and several in the lime industry are using both shrinkage and room and pillar mining methods. Low costs are said to be obtained, and there is no question about the cleanness of stone secured by mining. It was reported there were now 93 rock products companies using underground mining methods.

Taking the quarry industry as a whole, the economies of having two or more comparatively small air-compressor units in place of one large unit is quite evident, and these compressors are using direct connected synchronous motors in a great majority of cases, especially on new installations. Direct-connected synchronous motors have also been adapted to primary and secondary crusher drives (see Rock Products, April 27, 1929).

Greater care has been exercised in installing compressors, due to the publicity given the air receiver at explosion at Stone Mountain, Ga., early in the year, and the educational campaign by this publication setting forth the causes and prevention of compressed-air receiver explosions.



Loading stone to trucks in a limestone mining operation

There were no marked changes in preliminary screening practices, the rotary screen still holding sway in most of the new plants. However, there were some notable exceptions—the Penfield plant of Dolomite Products Co., Rochester, N. Y., where specially designed roll grizzlies were used, and the Naginey plant of the Bethlehem Mines Corp., where Robins roll grizzlies were used as scalpers. The new plant of the Newcastle Lime and Stone Co., Dunbar, Penn., uses Niagara vibrating screens for preliminary sizing where hitherto either rotary screens or live-roll grizzlies have been used.

For secondary sizing the vibrating screen has the limelight, there being very few exceptions of plants built during the year that did not install screens of this type in some manner or other to the exclusion of rotary screens. Novel features on these installations were numerous—to illustrate, at the

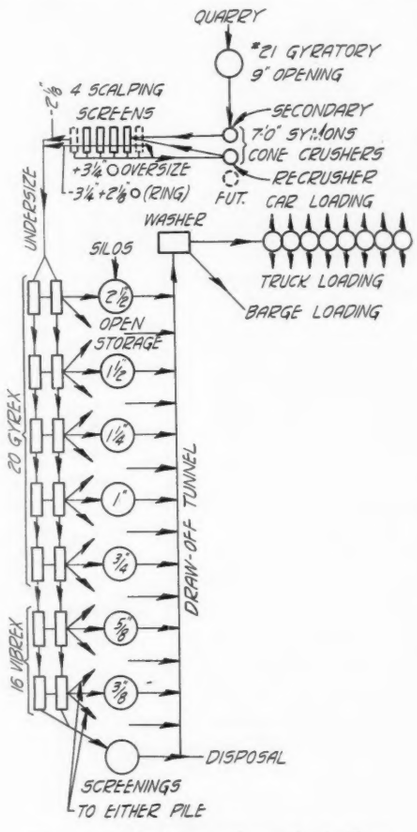
Tractors and trailers with crawler treads are used in a Kentucky quarry

Penfield plant previously referred to the vibrating screens are suspended with manila ropes to take up vibration, and with signal success. Another adaptation of vibrating screens is for portable plants and also for a portable screen for re-sizing stock piled materials. Another development is the mounting of vibrating screens under the car- or truck-loading spout at plants to give the products a final cleaning or remove excess fines or over-size. Wet vs. dry screening seems to be about equally balanced. Several plants added log washers or similar type machines for severe scouring of stone as a preliminary washing treatment and with satisfactory results. The washing of the smaller sizes of stone appears to be increasing.

The newer plants, with the exception of those built in the granite areas where jaw crushers for preliminary breakers are very popular, used gyratory crushers for that purpose, and one of the outstanding developments in crushing was the large number of cone type crushers installed as secondary reduction units. Hammer mills still hold the field as fine grinders for preparation of comparatively fine agricultural limestone, with mills of the roller type for fine pulverizing.

Several plants are drying while grinding, notably the Midwest Crushed Stone Co., Greencastle, Ind., for the preparation of limestone dust for special purposes. A novel development in this regard was that at the plant of the Herzog Lime and Stone Co., Herzog, Ohio, where three open gas burners were placed under vibrating screens for drying while screening. This was done to give better screening and to prevent caking in the bins of fine material (see Rock Products, December 7, issue).

Those plant operators who adopted Diesel power as a primer mover were not confined to out-of-the-way sections, for the reliability



Flow sheet of the New York Trap Rock Corp.'s new plant at Clinton Point, N. Y.

and economy of Diesel power has justified its use in competition with purchased electric power in many instances. The installations included Diesel-driven electric generators and distribution systems as well as direct engine connections to line shafts.

For transportation and elevation of materials in the plant and in connection with stockpile building and reclaiming the use of belt conveyors, with comparatively slow speed, larger diameter head and tail pulleys, with antifriction bearings is a decided trend, bucket elevators are being used only when limited space is the governing factor, apparently.

The new plants use speed reduction units of various design connected to electric motors practically universally, and a belt driven unit, outside of primary or secondary crusher, is each year becoming more rare.

Plant design and engineering skill has been directed at and has resulted in lower man power per ton of stone, as well as lower power consumption per ton of stone, and every advantage has been taken to produce clean stone at a minimum cost. Multiple-rope drives of the V-type are very popular and are used not only on primary and secondary crushers but on other plant units as well.

Segregation of stone in handling has received a large amount of attention. Many plants have installed mechanical devices to insure uniform loading of aggregate. Others have tackled this problem by endeavoring to have specifications such that a given grade of stone will not have such a wide variety of sizes.

The use of mechanical feeders, both of reciprocating and disc or roll type, in the new plants was quite noticeable, especially between the primary and secondary crushers. Their use invariably was as a feeder from a surge bin between the two units, this bin acting to take up the over and under on the secondary crusher, and thus permitting a greater capacity by uniformity or regularity of feed. A new type of feeder, under chains that are power-driven and rotate in the direction of flow of the stone were installed in the crushing plant of the West Penn Cement Co., West Winfield, Penn. A good example of the use of surge bins was at the Sturgeon Bay, Wis., plant of Dolomite, Inc.

Reclamation of broken or worn crushing and quarry equipment by improved welding methods and the use of various special welding and hard-surfacing alloys has been extensively practiced during the year. However, many quarry operators have yet to learn the advantage of hard-surfacing and protection from wear by means of electric or oxy-acetylene welding.

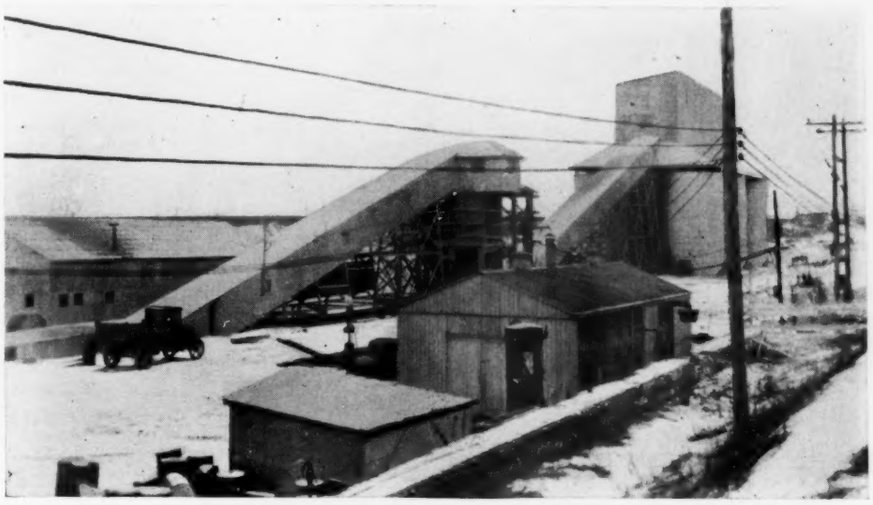
Progress in Safety

In 1928, according to U. S. Bureau of Mines statistics, 119 employes were killed and 10,568 injured in the quarry industry of

the United States. The death rate was reduced 10% and the injury rate 20% below that of 1927. The statistics for 1929 are not yet available, but efforts on the part of those who are in the industry have been notable and a still further reduction is confidently looked for.

Some Notable New Plants

One of the outstanding plants now under construction is that of the New York Trap Rock Corp., Clinton Point, N. Y., about eight miles south of Poughkeepsie. There perhaps has never been a crushed stone plant designed and built that has had more engineering talent and experience in its background. The plant was designed by the engineers and executives of the New York Trap Rock Corp., with the Burrell Engineering and Construction Co. as construction contractor.



The new plant of the Federal Crushed Stone Co., Buffalo, N. Y., uses vibrating screens throughout

Construction work started October 1, and the plant is expected to be in operation April 1, 1930. The plant will have a capacity of 6000 tons of crushed dolomite per day. A 42-in. Allis-Chalmers gyratory crusher will be used as a primary breaker followed by two 7-ft. Symons cone crushers for secondary crushing, driven by synchronous motors. Mack motor trucks will be used for quarry transportation. These trucks are built for 7½-ton loads.

Reinforced concrete silos will be used for storage, augmented by ground storage. Revolving screens will be followed by Robins vibrating screens.

The plant will have 32 belt conveyors ranging in widths from 48 in. to 20 in.; 1595 hp. will be needed to operate the belt conveyors alone.

During the year, the Federal Crushed Stone Co. completed a new plant near Buffalo, N. Y. This plant uses all dry screening and is of simple and economical construction throughout, built mostly of steel with some wood frame work. The arrangement of the plant's equipment is along a straight line flow and all machinery that is not direct-connected to electric motors has speed reducers or Texrope drives. Push button controls are used on all the motors except the primary crusher. Niagara vibrating screens are used for scalping and screening and surge bins equalize the flow of stone from the scalper to screens. Silos are used for storage augmented by outside storage as well.

In the Chicago district the Elmhurst Chicago Stone Co. is building a new plant of 300-ton per hr. capacity which will use Stephens-Adamson vibrating screens throughout. One of the novel features of this plant, while not entirely new, is the use of a 500-ton surge bin between the primary crusher and the secondary crushing units; this bin will be able to run the balance of the plant almost two hours in the event of trouble with the primary crusher or of quarry delays.

The primary vibrating scalping screen is designed to handle a screen with 5½ in. openings, the first of this large size to be installed at a crushed stone plant. There are 10 vibrating screens, one single decked 5x8-ft. scalper, six double-decked screens each, 4x8-ft.; one 3x6-ft. triple-decked and two 4x6-ft. triple-decked for final classifications. At this plant two Amsco, nonbending, 36-in. pan conveyers, one of 10-ft. length and the other of 16-ft., will feed a 5½-ft. Symons cone crusher from the surge bin. A 3-ft. and a 4-ft. Symons cone crushers will be used for final reduction units. Storage will include 12 reinforced concrete bins holding 300 tons of stone each.

The Hawkeye Portland Cement Co., Des Moines, Iowa, is installing a crushing and screening plant having a capacity of 200 tons per hour. The plant will supply crushed aggregate for commercial stone as well as limestone for the cement plant. It is expected that 700,000 tons of limestone will be shipped from the company's plant during 1930, half of which will go for highway work in Iowa.

An example of a modern new crushed stone plant of comparatively small capacity but having engineering attention given to its design and construction comparable to some of the larger plants was the new plant of the Kentucky Consolidated Stone Co., Lexington, Ky. This plant was designed by the Smith Engineering Works. A complete description of this plant will appear in a later issue.

The Standard Trap Rock Corp. won a legal decision leading to the right to operate its partly completed new plant at Piermont, N. Y. This plant was built during 1928, but the Palisades Interstate Park Commission ruled that the beauty of the Palisades would be marred by its operation. This year a United States district court granted an injunction restraining the park commissioners from interfering with the operations (see Rock Products, July 6, 1929). It is expected that the plant will be completed soon.

Mergers

One of the principal mergers in the crushed stone industry in 1929 and of particular interest because the president of the parent company, W. F. Wise, is the president of the National Crushed Stone Association, was that of the Southwest Stone Co., Dallas, Tex. The Southwest Stone Co. includes the former Stringtown Crushed Rock Co., McAlester, Okla., and the Texas Trap Rock Co., Knippa, Tex., and the Texas Stone Products Co., Chico and Bridgeport, Tex. At the present time the Southwest Stone Co. is operating plants at Stringtown, Okla., Chico, Knippa and Bridgeport, Tex. The average yearly production of these plants will be approximately 640,000 tons.

There were several other consolidations during 1930, two outstanding ones on the Pacific Coast, that of the Consolidated Rock Products Co. in the Los Angeles territory and the Pacific Aggregates Co. in the Bay districts of San Francisco. While these consolidations were mostly of sand and gravel companies, there were inclusions of some stone producers, and they indicate a trend to consolidate the aggregate industry under one leadership—both crushed stone and gravel. There was also a noticeable trend for crushed-stone producers to add sand and gravel plants to their operations.

The Belmont-Gurnee Co.'s interests were reported sold to the New York Trap Rock Corp. (June 8 issue Rock Products). The Callanan Road Improvement Co. purchased the Albany Crushed Stone Co. (Rock Products, May 11). The Consumers Co., Chicago, Ill., added to its already extensive quarry business by the purchase of the A. C.

O'Laughlin Co. One of the most important mergers was that of the Rock-Cut Stone Co., Syracuse, N. Y., and the General Crushed Stone Co., Easton, Penn.

The incorporation of the Eastern Rock Products, Inc., at Utica, N. Y., formed a merger of the Boonville Sand Corp., the Peerless Quarries, Inc., and the Broome County Sand and Gravel Corp. (ROCK PRODUCTS, May 11). The Erie Stone Co., one of the France companies, purchased Logansport Lime and Stone Co. (ROCK PRODUCTS, October 12). The France Stone Co. purchased the Bascom Quarries Co., and the William L. Urschel Lime and Stone Co. (ROCK PRODUCTS, September 14). The Interstate Crushed Stone Co., was bought by the North Jersey Quarry Co. (ROCK PRODUCTS, March 16). The Ohio Blue Limestone Co. was sold to the National Lime and Stone Co. (ROCK PRODUCTS, June 22).

The Prince Stone and Lime Co., near Wheeler, Va., was sold to Kentucky Consolidated Stone Co., The A. T. Small Quarries were reported sold to the Weston-Brooker Co., Columbia, S. C. (ROCK PRODUCTS, November 23), and this latter company was also reported as merged with the Southern Crushed Stone and Granite Co. under the name of the Weston and Brooker Co. (ROCK PRODUCTS, June 22).

Association Activities

The directors of the National Crushed Stone Association approved a code of trade practices which will be submitted to the annual convention to be held at Cincinnati, January 20 to 23, 1930. The New York Crushed Stone Association held meetings through the year as did the Pennsylvania Stone Producers Association, and in reviewing these meetings it was apparent that they were accomplishing a real good in their districts and the contacts the members made with each other removed many of the petty jealousies that are so apparent where producers do not frankly and openly discuss their differences. The local associations in Texas and in the South Atlantic States likewise apparently improved conditions, but because their members are scattered over a larger territory it is more difficult to bring them together.

An interesting development in the industry was the organization of the Mineral Aggregates Co-operative Association, Milwaukee, Wis. The association was chartered under a law designed to permit co-operative buying and selling of agricultural products, but owing to an interpretation handed down by the state's supreme court the plan was extended to building material dealers. Recently one of the members was sued by the association for a breach of contract; the plaintiff alleged that the member had broken his agreement to sell his output only through the association. This led to difficulties and the practical abandonment of the organization, for the present at least.

Art Stone as a Quarry Byproduct

The flagstone industry before the advent of portland cement was one of considerable volume, but for many years its production dropped to a very low figure. Recently several companies have added to their regular stone production the sale of this material. One company, the Standard Lime and Stone Co., Fond du Lac, Wis., reopened an old quarry for production of this class of stone and reports a large volume, 100 cars being shipped into the Chicago territory alone from that district the past year.

An artistic use of flag stones

New Incorporations

There were 69 new incorporations reported having a total par value of $9,562,090, not counting those which placed no par value on their stock. Last year's incorporations totaled 73 with capitalization of $5,758,000 on a similar basis. Ten companies in 1929 were reported in the hands of receivers, with liabilities of over $145,000 and assets of $76,046, although news items on five of the companies which failed did not state liabilities or assets. Some 26 new plants were reported built and 76 operators indicated that they had made alterations and additions to their present quarry or plant equipment. This compares with seven new plants reported established during 1928 and 113 reporting improvements. Of the new plants reported as built six were in the East, five in the Midwest sections, two on the Pacific coast, with the South accounting for twelve. These statistics probably are far from complete, but they at least show tendencies.

INCORPORATIONS—1929

	Number of Incorporations	Total Capitalization
Alabama	1	.....
Arkansas	1	$ 10,000
California	1	1,000,000
Colorado	2	150,000
Delaware	6	4,300,000
Florida	2	4,300,000
Illinois	..	.....
Indiana	8	260,000
Maine	1	10,000
Maryland	1	.....
Missouri	3	50,000
New Jersey	2	250,000
New York	8	821,000
North Carolina	5	800,000
Ohio	2	32,090
Pennsylvania	2	35,000
Tennessee	5	671,000
Texas	5	475,000
Virginia	3	160,000
Vermont	2	30,000
Washington	2	123,000
Wisconsin	7	385,000
Total for 1929	69	$9,562,090
Total for 1928	73	$5,758,000
Canada	12	$ 276,000

Atlanta Lime Rock Preparing to Operate

WORK was begun recently by the Sandersville Railroad in extending a sidetrack west from its main line to the lime rock lands of the Atlantic Lime Rock Corp.

The Atlantic company, which was recently chartered, has a capitalization of $30,000 and plans to install a steam shovel and rock crusher with a capacity of 1000 tons daily. The material to be mined will be used by the state highway as a base of asphalt roads.

The plant will be located between Tennile and Sandersville. Power will be furnished by the Georgia Power Co.—*Sandersville* (Ga.) *Progress.*

Asphalt Producers Form Institute

THE ASPHALT INSTITUTE, a new organization whose membership is made up of the producers of asphalt and asphaltic oil responsible for more than 90% of the production east of the Rocky Mountains, succeeded The Asphalt Association on January 1. The new organization will conduct extensive educational and research work.

Sand and Gravel in 1929

ESTIMATED production of sand and gravel in 1929, based on cognizance of conditions in large producing areas, returns from questionnaires and other reliable sources, is about 198,000,000 tons, or the same as in 1928. This figure is exclusive of silica sand, a report of which is given on other page in this issue. Prices were generally lower in the first part of the year but showed later improvement due to stabilization efforts by large producers in different parts of the country, notably California and around Columbus, Ohio.

Mergers

Two of the most important mergers occurred on the Pacific coast. In one of these nine large aggregate producers, operating a total of 21 producing and 25 distributing plants, consolidated into the Pacific Coast Aggregates, Inc., constituting a substantial majority of the important producers and distributors in central California of sand and gravel. The properties involved were appraised at approximately $20,000,000. By the action of this group the Pacific Coast Aggregates, Inc., becomes one of the world's largest sand, rock and gravel producing and distributing companies.

The Consolidated Rock Products Co. was formed by a consolidation of three of the largest producers in the Los Angeles district, the Union Rock Co., the Consumers' Rock and Gravel Co. and the Reliance Rock Co. The combined facilities include 41 plants, 23 of which have aggregate capacities of 4500 tons per hour, and 21 storage and distributing stations, equipped with modern loading devices. These plants and bunkers are located in ten counties in southern California covering a territory of 2000 square miles and so distributed that no important job is more than a few miles from a distributing point. Production capacity is about 10,000,000 tons per year with present sales aggregating 8,000,000 tons, representing 75% of the shipments in the territory. The capitalization of the Consolidated company is about $12,000,000.

In the East, the Warner Co. absorbed the Van Sciver Corp., Philadelphia, both large producers in that district. By this acquisition the Warner Co. becomes the largest factor in the sand and gravel industry in the Pennsylvania, New Jersey and Delaware territories. The deal involved $10,000,000 and brings to the Warner company two sand and gravel plants and 1000 acres of land near Trenton, four retail yards in Philadelphia, the Knickerbocker Lime Co. plant and limestone deposits near Paoli, as well as a fleet of 100 barges and tugs, and a very large fleet of motor trucks. The company's present production is about 5,500,000 tons of sand and gravel per year. In addition, two ready-mixed concrete plants, each of 400 cu. yd. per day capacity, are in operation at two of the six retail terminals owned by the company.

The Rogers Sand Co., Pittsburgh, Penn., operating sand and gravel plants, properties and marine equipment, valued at nearly $2,000,000, was consolidated with McCrady Bros. Co., large building supply dealers and contractors of that city. The combination becomes a dominant factor in the local industry.

Mergers of the principal producers in the St. Louis, Mo., district into two strong companies, Central Sand and Gravel Co. and the Standard Materials Corp., the first company taking over the sand and gravel department of the Alpha Portland Cement Co., the Gravois Material and Supply Co., Meramec Portland Cement and Materials Co. and the Ruprecht Sand and Material Co. The Standard company is a combination of the sand and gravel operations of the Missouri Portland Cement Co., the Mississippi River Sand and Material Co. and the St. Charles Sand Co.

The above are the outstanding mergers, but there were a number of smaller consolidations throughout the country. Large companies such as Eastern Rock Products, Inc., Utica, N. Y., and the American Aggregates Corp. expanded their operations so as to virtually blanket the territories in which they are operating.

The extent of the mergers consummated and expansion of large companies involved considerable new financing. The sum total of this financing (not taking into account that which occurred within other companies) was $36,455,000, the largest amount of securities in sand and gravel companies ever offered for sale to the public. A list of the offerings follows:

Consolidated Oka Sand and Gravel Co., Ltd., $2,000,000.
Construction Materials Co., Chicago, $3,500,000.
Consolidated Rock Products Co., $11,695,000.
Canada Paving and Supply, Ltd., $2,000,000.
Standard Paving and Materials, Ltd., $1,500,000.
Ohio River Sand Co., Louisville, Ky., $2,260,000.
Pacific Coast Aggregates, Inc., $5,500,000.
Warner Co., $7,000,000.
American Aggregates Corp., $1,000,000.

National Association

The research and engineering work conducted during the past year is given in detail on other pages in this issue. The board of directors has decided to hold a trade practice conference of the sand and gravel industry probably in 1930. After an exhaustive study during the course of the last two years, the depreciation committee completed its work and incorporated its findings in a report which it has submitted to association members and the Commissioner of Internal Revenue. Other important developments were: Report of car cleaning and repairing costs (now under advisement by the American Railway Association); unfair sales policies of machinery manufacturers, such as extension of long-term credits to prospective producers, etc., which in many cases leads to over-planting and consequent over-production; compensation insurance rates in marine and gravel operations; simplification of commercial sizes of sand and gravel.

Local Association Activities

To secure closer co-operation between producers and specification-making bodies within certain states or districts, the producers have in many instances organized into local groups similar to other state associations. The organizations devote themselves to the promotion of co-operation within the industry in the solution of common problems. Some of these associations employ competent engineers for the purpose of helping producers comply with specifications for important concrete work. Incidentally, promotion of uniform specifications for counties, cities and towns is part of the engineer's duties.

Members of the state associations have long felt that the problem of the wayside-pit producer would no longer exist if such producers could be made to comply with the specification requirements the established plants do. But inasmuch as it is almost impossible to get the states to make a washed sand specification, the best proposition is to have more rigidly enforced grading and cleanliness. Again, it is not competition with properly prepared material that is feared but that with poorly made and unfit aggregate from these road pits.

One suggestion, and a quite logical one, is for co-operation by the railways. That is, to get the railroads to put through a temporary low freight rate to the job point, leaving the contractor little reason for opening his own pit. Some railroads already have this under consideration.

New state associations formed in 1929 include the Mississippi Sand and Gravel Association, Oklahoma Sand and Gravel Association, Western Pennsylvania Sand Producers' Association and Southern Sand and Gravel Association.

Tariff

Competition from Canadian producers was

experienced in the Great Lakes basin area, principally at Cleveland and Detroit, but even at Chicago. The original complaint came from domestic producers competing with water-borne materials, but investigation is said to have shown that other market cities near the Canadian border were affected. The charge was made that Canadian producers were dumping materials on the American markets at prices substantially lower than those obtained in their home markets with the consequent demoralization of American market conditions.

In a formal petition, a duty of 5 cents per 100 lb. was asked. The petition called attention to the growing trend of imports (600% increase since 1922), and emphasized that should the imports grow at this rate, many American producers would lose markets on which they are dependent for a considerable portion of their business.

Accident Prevention

Accident prevention has come in for more serious thought among producers than ever before. For the first time, a concerted effort has been made to reduce hazards and the National Association in co-operation with the United States Bureau of Mines, worked out the details of a competitive safety contest for 1929, the winners of which are to receive the Rock Products safety trophies. The results are expected to show where the weaknesses in safety work lie and no doubt in the succeeding years, many of the accidents will be reduced to a minimum.

That safety work is an economic as well as a humanitarian necessity in the industry can best be appreciated by the stand insurance companies take. One company states that prevailing compensation rates are very high, indicating that it is one of the most hazardous industries or that there are an extraordinary number of accidents or very costly accidents in the industry. The prevailing rate for Massachusetts is $4.93 per $100 of payroll, New York, $5.99 per $100 and Connecticut, $4.20 per $100.

Traffic

The Interstate Commerce Commission has instituted a new Hoch-Smith case, to be known as No. 17000, Part 11-A, rates on sand, gravel and crushed stone, from and to points in Kansas and Missouri. The creation was at the instance of the Missouri commission. It made representations to the federal body in respect to the lawfulness of rates on the commodities mentioned and related commodities between points in Missouri and points in Arkansas, Oklahoma and Kansas.

At a recent meeting in Kansas City, attended by 40 producers of sand, gravel and crushed stone, the situation was discussed and it was decided to present a united case before the I. C. C. It was generally agreed that the 17000-11-A scale was too high for the shorter haul, but somewhat higher rates might be conceded for long hauls. A shippers steering committee headed by John Prince, president of the Stewart Sand and Material Co., named to have charge of the case selected a commerce counsel and have gone about securing a fund to prepare the case; this fund is being raised by subscription from the producers in this district.

Technical Developments

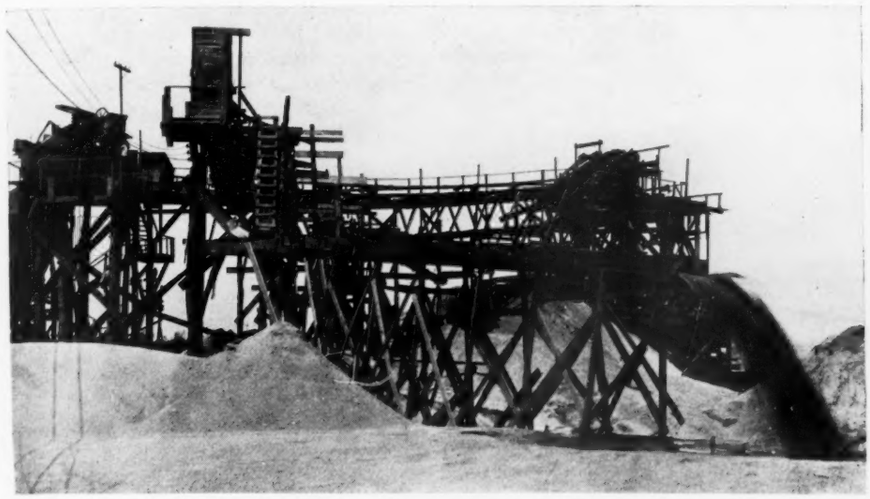
In the development of deposits an increasing tendency towards dredging is noted, where dredging is possible. In numerous instances the operator has opened his pit by the usual power excavator method and then when a sufficient area has been opened, flooded this area and installed a suction dredge pumping outfit. Where the banks are hard-cemented, blasting is resorted to and the material brought down into the pond, later to be removed by the dredges. The important factors which have brought this about are chiefly the flexibility of excavation due to the mobility of the dredge boat, and the greater capacities with more economic distribution of labor and power costs. Of course, extension of the pit is facilitated also. A preliminary wash is given the materials, which takes off some of the load in the washing plant. It must be said, however, that a large supply of water must be had in order to carry out the above. Along the Platte river, Nebraska, the operators prefer a movable washing plant operating in conjunction with the dredge. These plants are moved to locations along the shore nearer the dredge's activities from time to time so as to cut down pumping costs.

More vibrating screens are being used for all types of screening in sand and gravel plants. An interesting example of the modern use of these screens is in the plant of the Fort Worth Sand and Gravel Co. Here fines ⅛-in. down are removed by a rotary scrubber and the oversize carried to the head of a battery of vibrating screens where it is handled successively by six 4-ft. by 7-ft.

Battery of vibrating screens in use at the Fort Worth Sand and Gravel Co.'s plant by which all sizes from 1/4-in. sand to 2 1/2-in. gravel are prepared

single deck, open type Leahy screens. Oversize of these screens at each separation is stocked below the screens, and undersize carried by belt conveyor to the next screen in the series. One of these screens is used at each sizing point to produce 2½-in., 1½-in., 1-in. and ½-in. gravel, and the ¼-in. sand separation at the end of the products to meet constantly tightening specifications.

At the American Aggregates Corp.'s newer operations, dredge, dragline or shovel loading, according to local conditions, is used. In the dredging plants, it was found that pumping to field hoppers from which industrial cars load, has effected economies over long distance pumping. The cars are then hauled to a track hopper serving a belt conveyor or a skip that makes the final delivery to the scalping screens. This company is still strong for rotary scalpers and finishing screens in conjunction with drag classifiers for the classification of the sands. In some cases, as at the Indianapolis plant, sand-settling tanks are in use.



A mechanical washer and classifier at a New Jersey plant

plant is handled by two Leahy screens. The capacity of this vibrating screen plant is given as 200 tons per hour.

Washing and Classifying

Installations of mechanical washers and classifiers is on the increase. The first use of Dorrco washers and classifiers in gravel plants was noted several years ago and the number has increased steadily. The Shaw classifier, a recent development, has been installed at a number of plants. These classifiers are used in series to effect separation of different grades of sand. The Allen Cone Co. has found a developing market. These are mentioned merely to show the trend toward more elaborate equipment and better

On the Pacific coast, several operators are using a modified design of the old waterwheel classifier. These companies are working deposits which contain excessive amounts of fine sand, which hitherto have been difficult to remove and made it practically impossible to market the material. These classifiers resemble a paddle wheel with fixed buckets on the periphery and the classification depends on the rotation speed of the wheel.

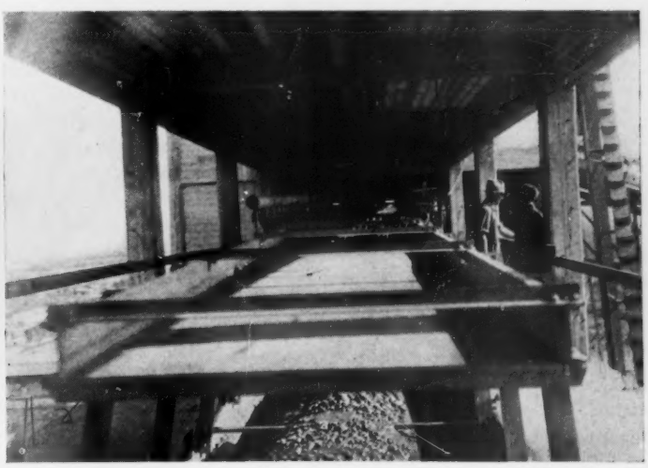
Two innovations emanate from the new Roscoe, Calif., sand plant of the Blue Diamond Materials Co. The first of these involves the use of a movable crusher house of frame construction on skids which can be carried with its contained equipment to desired locations. This enables the operation to be adapted to the varying working conditions that come from opening the pit. There is also a novel shaker screen, 50 ft. long and 54 in. wide, set on inclined hardwood slats that act as springs as well as supports. At the drive end of these screen are two heavy flywheels about 4 ft. in diameter, each weighing 2½ tons. A 7-in. shaft supports them. Outside the flywheels are the wooden pitman's, which communicate the reciprocating motion to the screen. As with the screen below, the support of the screen frame is a number of hardwood slats, which act as springs as well as supports. The stroke is about 1½ in. and the speed 240 r.p.m., and the motion is faster one way so as to throw the material forward. The screen has S. K. F. bearings and is driven by a 25-hp. motor through a belt.

Shaking screens have been tried and discarded in several gravel plants because of the effect of the vibration on the building, but such buildings were of wood fastened with spikes or bolted joints. With heavy reinforced concrete construction of this plant no effect of vibration can be felt.

It has several advantages, the main one being that the material is conveyed as well as screened without having to build a supporting structure to a great height, as with the ordinary rotary screens, where the material flows through by gravity. Also, it is a simple matter to change screens, which are flat plates or frames with perforations that can be lifted out and replaced in a few moments.

For the small to medium size plants, the slackline cableway excavator and power

Movable crusher house at the Blue Diamond Co.'s sand plant



Novel shaker screen, 50 ft. long by 54 in. wide at the Blue Diamond plant

drag scraper are more than holding their own. This type of equipment also affords the producer an economical means of storing and reclaiming.

Transportation

Development of self-unloading boats of large capacities continued until now practically every large water operation has put some type of these in service. In the Chicago district, the motorship, *Material Service,* built especially for the Material Service Corp. by the Leathem D. Smith Co., Sturgeon Bay, Wis., is noteworthy. The boat operates between the plant on the Chicago drainage canal at Lockport, Ill., and the company's Chicago distribution yards, making daily trips. The boat is built like a submarine and is lowered by means of interior water tanks. When the tanks are filled, the boat is lowered enough to clear the bridges which span the Chicago river and the canal between Chicago and Lockport; thus no interruption to highway and railway traffic is occasioned. The ship is 246 ft. in length, with a 40-ft. beam and light head room of 14 ft. 6 in. It has a capacity of 2500 tons at 13-ft. draft, with an unloading capacity of 500 tons per hour and a speed in still water of 10 miles per hour. Two Winton Diesel engines, each of 350 hp., furnish power for propelling the boat, and also operate the loading and unloading facilities. The self-unloading features comprise a tunnel scraper system with two 4-cu. yd. scrapers delivering to the 90-ft. conveyor boom by means of a short belt conveyor. This equipment is collapsible so as to lie close to the deck when passing low bridges. A 15-in. dredging unit has been installed on the boat so that it can be used to work on Lake Michigan. Sand so dredged can be dewatered by boxes installed on the boat and the dewatered sand distributed over the length of the hold.

The increased use of water haulage has made necessary the establishment of distributing yards within the limits of the principal distributing cities. These yards are equipped with batching and truck loading bins and in many instances a line of building materials is carried. The establishment of retail yards is not confined to larger operations, many smaller companies having found that distribution economies can be effected in this way.

Batching Plants

A great many plants, especially those serving local trade, have installed batching devices for making mixtures of aggregates according to desired specifications. Demand for ready-mixed concrete, especially in the large cities, has increased to such an extent that several producers have installed such plants. Outstanding examples of these are the Boston Concrete Corp., owned and operated by the Boston Sand and Gravel Co., at its Cambridge, Mass., retail yard (see Rock Products, November 9); the Ross Island Sand and Gravel Co.'s 400-yd. per day plant at Portland, Ore. (to be described in an early issue).

Washed Gravel

The development of the washed and graded gravel industry was accelerated by the increasing construction of concrete roads. Its greater use was restrained by restricting specifications in many states, which many gravel plants were unable to meet because of inadequate equipment. But the modern gravel plant with excellent washing facilities, crushers and screening apparatus, is now producing material which meets the exacting requirements. In New York, the adoption of the two-course road in which gravel 50% or more crushed is required, has stimulated the industry. Pennsylvania, which hitherto had restricted its use to culverts, bridges and secondary pavements, has let down the bars and specifications on the late September lettings provide "the coarse aggregate shall be crushed stone or crushed washed gravel—the gravel to be partially or totally crushed pebbles." This has been interpreted by highway officials to mean that the aggregate may contain uncrushed pebbles but a substantial percentage must be crushed. Further provisions state that "gravel shall consist of tough, durable pebbles of high resistance to abrasion, free from clay or coatings of any character. Crushed gravel which contains disintegrated or soft material or shale or an excess of flat pieces shall not be used." Strict requirements but in all quite satisfactory to the gravel producers in the district who are of the opinion that gravel will be given a fair trial and accepted on its merits.

The motorship "Material Service," self-unloading boat designed to pass under low bridges

Tendencies

Fewer plants, but those better built and equipped, was the general rule in 1929. The large plants favored the dual unit system. These units have identical equipment and can be operated together or independently as desired. There was a strong tendency in the new design to eliminate as much as possible the "human element" in operation—that is, to mechanize the plant to such an extent that only supervision and very little manual labor was required.

Northeastern States

An increase in production was apparent in this district, the declines from the New England states and New Jersey being more than offset by large gains from Pennsylvania and New York. In and around Boston, the slump in building was reflected by a decline of over 5% in production. Lower prices prevailed in the area, possibly from 5 to 10% under the 1928 figures. Less road construction caused a decrease of about 20% in Connecticut production; what material was sold went at prices considerably lower than that received in 1928. Declines in consumption were gradual, the break occurring chiefly in the first part of the year. Better conditions are anticipated for 1930 with prices remaining about the same.

Production in New York, judging by returns, showed an increase of from 7 to 10%, the greater part of this coming from the upper districts, due to the increased building of roads in which considerable gravel was used. Several new plants represented part of this increase. Prices remained about the same as last year, some localities even getting slight increases. Considerable optimism for next year's business prevails.

Practically all of the Pennsylvania producers reporting showed increased production, the greatest increases being recorded in the Pittsburgh district. Prices showed no decline but on the other hand showed but little tendency to rise.

For 1930, the Pennsylvania Highway Department has announced the most ambitious road building program ever undertaken by any one state in a single year. Over 2,000,000 tons of sand and 3,600,000 tons of crushed stone and gravel will be required for the 1400 miles of roads to be constructed during the year.

New Jersey production continued to decline with prices weak. A few gains were offset by the lower prices received, in some cases 25% less than in 1929. A larger amount of money has been made available for townships and boroughs for 1930 and this may lead to more road construction.

Significant Developments

One more crushed stone producer and one slag producer in New York entered the sand and gravel industry—the Cushing Stone Co., Schenectady, who purchased the two Neil F. Ryan plants and deposits at Scotia, and the Buffalo Slag Co., acquired the J. E. Carroll Sand Co.'s plants at Franklinville and Attica. Later the Cushing company bought 45 acres of gravel land also near Scotia. The

Eastern Rock Products, Inc., added to its holdings through the purchase of deposits in Chenango from the Broome County Sand and Gravel Co. The Metropolitan Sand and Gravel Co. bought the Hall properties on Long Island for development.

A bitter fight over the right of the Great Eastern Sand and Gravel Co. to dredge the underwater lands owned by the town of Port Jefferson, Long Island, is being waged.

Storage silos at the Clarence Sand and Gravel Co., Clarence, N. Y. The housing at the lower right contains the automatic weight recorder

The Great Eastern company was recently given a renewal of its permit by the local authorities but a group of citizens are claiming fraud and other practices were used in getting it. At the last report, this group had succeeded in obtaining a temporary restraintive injunction. Dent and Kent, Inc., installed a second dredging unit and new 1200-ton trucking plant on Long Island.

The Clarence Sand and Gravel Co.'s new plant at Clarence has a number of interesting features. Several sizes of sand are made, vibrating screens and Shaw classifiers being used to make an effective separation suitable for the rigid state specifications and for gypsum plaster. Concrete bins are used for storage. Unusual arrangements have been made for rail loading and for rewashing gravel before loading. A Merrick "Weightometer," which automatiaclly records the weight of the material passing over the conveyor belt to the railroad cars, is one of the interesting installations at this plant.

In Pennsylvania two new operations of considerable size are noted: the Madison Sand and Gravel Co., Susquehanna, and the Wyoming Sand and Stone Co., Wilkes-Barre.

Southern States

Increased production was reported from Alabama, and though returns from Tennessee are rather incomplete, that state will probably also show increased production on account of several new plants. The demand fluctuated but gradually strengthened so that several large producers in those states feel justified in making extensive improvements in plants and equipment in anticipation of a better year in 1930. Low prices prevailed.

There were too few returns from North and South Carolina and Mississippi to estimate production, but it was probably lower than last year. Failure of Florida to revive to a sufficient degree this year eliminated an expected market for producers in that and neighboring states.

Reports from Virginia are rather meager, only one company, Richmond Sand and Gravel Co., being noticed as making major improvements. This company is planning a new sand and gravel storage and distributing plant at its James river operation, to cost over $250,000. The N. Q. Speer plant at Goshen was completed early this year.

Dredging operations in Tennessee were improved in general, many plants augmenting their floating equipment. The Central Sand and Gravel Co. installed what is said to be the largest Diesel towboat in the South; powered by two 360-hp. Diesels, the new boat is used to tow barges of material from the dredging operations to the Memphis plant. The Cherokee River Sand and Gravel Co., Knoxville, put a new steam dredge in operation, and the H. C. Milnor Sand and Lime Co. of the same city replaced a dredge it lost through sinking. At Knoxville also the Oliver King Sand and Lime Co. added new marine equipment, bins, and made other plant improvements. The Cumberland River Sand Co., a new company, purchased the Richardson Sand and Gravel Co., East Nashville, and put a 225-ton per hour Diesel-driven dredge in service. The Dixie Sand and Gravel Co., Chattanooga, subsidiary of the Pennsylvania-Dixie Cement Corp., added a steam towboat and six all-steel 650-ton barges as part of a $150,000 improvement program. A new 40-car plant, storage bins and connecting track to railroad was put in operation by the Estill Springs Sand and Gravel Co., Estill Springs.

In Louisiana the Belle Cheney Sand and Gravel Co., a new company at Opelousas, is to build a plant on a 1000-acre deposit recently acquired at Belle Cheney Springs. The Parker Gravel Co. installed a new 1½-cu. yd. Diesel dragline, making the fourth, at its pit at West Monroe. The Forest Gravel Co. is now operating its new plant at Alexandria. In South Carolina W. A. Todd purchased a 60-acre deposit at Dunbarton and is installing equipment and plant to produce 25 cars per day.

A $150,000 plant is planned by the Coastal Construction Co. at Handsboro, Miss. The company plans to use a 10-in. dredge; shipments will be made by water. The Copiah Gravel Co., Crystal Springs, was sold to Arkansas interests who are contemplating extensive improvements. Power changes were made at the Forrest County Gravel Co. plant so that the operation is now one of Diesel-electric.

The Kentucky Consolidated Stone Co., Louisville, Ky., entered the sand and gravel business through the acquisition of the Ohio River Sand and Gravel Co., Paducah.

Central States

Improvements to existing plants and the establishment of several large new operations resulted in a 5% production increase in Ohio. Excellent construction weather forced Ohio producers to the limit to supply demands for material quite early in the year. A rainy spell in April cut down shipments but producers worked at near-capacity to replenish stock piles. Business in the Columbus district was quite good, a large volume of small home and apartment building offsetting the decrease in class "A" construction. Prices about Columbus were firm but lower; breaks ranging from 10 to 25% under 1928 levels were reported in the Cincinati district. The apparent stability of the Columbus market is due to co-operation among the producers who have agreed to a marketing distribution plan recently formulated. By this method, an independent agency allocates sales and deliveries of material to the different companies on a basis of their percentage of sales in the last two years.

A number of railroads have contracted for large amounts of ballast and these contracts will carry over into 1930, giving the producers an assurance of at least a fair operating season next year.

The American Aggregates Corp. expanded its operation in the state; the new Miamiville plant, a 450-ton per hour operation, one of the most modern in the Cincinnati district, was described in detail in Rock Products, May 25, 1929. At Columbus, the American company spent $30,000 in improving the plant acquired from the Concrete Materials Co. A new skip hoist, rotary screen and vibrating screen were installed, New gravel areas were made available along the Scioto river so that about 240 acres are now controlled. Two new plants, one at Hamilton of 3500-ton per day capacity, and another at Springfield of 1500-ton per day capacity, were completed by the

company. The Hamilton operation at present using the usual type of shovel excavator, will be changed to a dredging operation as soon as sufficient area and depth for a pond has been made. The Springfield plant uses a 2-cu. yd. slackline cableway.

The Arrow Sand and Gravel Co. improved its plants, installing special truck scales at both, which automatically indicate the weights. Its Franklin plant, the newer of the two, has been augmented by a "Truck" mixing concrete plant, and equipment for loading and batching aggregates. Several trucks with special bodies designed by Stephen Stepanian, vice-president of the Arrow company, are in use to carry ready-mixed concrete and also mixed aggregate; (see Rock Products, November 9).

Notable New Plants in Ohio

The Sturm and Dillard Co. plant at Circleville, completed in 1928, made a number of changes enhancing both efficiency of operation and cleanliness of product (Rock Products, November 9). The Van Camp Sand and Gravel Co.'s new plant near Cincinnati, described in Rock Products, August 3, as a "frictionless gravel plant," is a fine example of how far anti-frictionizing can be carried in modern design. It produces 300 tons per hour, has no elevators, is completely electrified and uses direct drives wherever possible. The Muskingum River Gravel Co. installed a new derrick boat and an all-steel Diesel-powered screening boat. This latter has some novel features and is equipped with rotary scalping screens, vibrating screen, 3-ft. Symons crusher. Two sizes of gravel and one of sand are produced; the gravel can be 100% crushed if desired. Production is from 600 to 1200 cu. yd. per 10 hr. day, depending on the amount of crushing required. The Vermillion Sand and Supply Co. added a special low draft all-steel Diesel-powered dredge. At Wapakoneta, the Wapak Sand and Gravel Co. replaced its plant built last year with a modern 600-ton-per-day operation.

At Steubenville, the Eastern Ohio Sand and Supply Corp. was organized to take over the company of the same name and the combined East Liverpool Sand Co., East Liverpool. The company's Steubenville plant will be completely electrified in 1930 and modern handling equipment installed. Early in the year, the Marion Sand and Gravel Co. of Marion bought out the Richwood Gravel and Stone Co., Richwood, 15 miles southeast of Marion. A new 500-ton per day plant was built at Kent by the Garland Sand and Block Co., and Johnson and Sons Sand and Gravel Co., Tippecanoe City, was reported as having acquired 150 acres near its present plant on which a new plant will be erected. A small plant was put into production at Newark, Ohio, by the Newark Sand and Gravel Co. The plant and leasehold owned by the Midway Sand and Gravel Co., was sold at a sheriff's sale for $5934, somewhat under the appraisal value of $8900. A small plant was put in operation at Krumroy by the Builders Sand Co., and at Camden by the White Gravel Co.

Michigan. Michigan plants in general were fairly busy so that it is probable a small increase in production can be expected. These operations shipping into Detroit were forced to meet low prices on account of competitive Canadian material and lack of any great volume of major construction. There is a fair carry-over of road construction and with that projected for 1930, better conditions are expected for next year. The price outlook is pessimistic.

The Ferrysburg, Mich., plant of the Construction Materials Co. is being completed and production will probably begin next spring. This is a 2,000,000-ton per year operation, shipping principally by boat into Lake Michigan markets. Champion Sand and Gravel Co. acquired 25 acres near Iron River and is building a new plant. The Valley Sand and Gravel Co. is now operating at Benton Harbor, and Thomas McNally has a 500-ton plant at Ross Crossing.

Indiana Conditions

Indiana. From a volume standpoint, producers in Indiana enjoyed a good year, but if prices are considered, the returns are not so satisfactory. The early spring rains continuing well into May upset shipping schedules and postponed considerable construction. Indiana's large highway program combined with extensive orders for railroad ballast, made up the major production. Heavy shipments from Illinois producers into the Terre Haute district caused serious curtailment and price declines; two large operators in the district report a falling off of 35 to 40% in production. In Indianapolis, a greatly overplanted area with only a normal consumption was a region of excessive overproduction and extremely poor prices. Again, the large road program for the state saved a serious situation. Lower prices predominated practically everywhere in Indiana but producers are expecting a rise in 1930 for such materials not already contracted for. They certainly cannot go any lower. The recent erection of a few large plants in strategic locations will probably help the situation.

The situation in Indianapolis remained unchanged—too many plants with not enough consumption. Two factors are expected to alleviate this condition—the new 5000-ton per day plant of the American Aggregates Corp., which will do much to force the other producers in line, and the large state road progrma for 1930. Overproduction in the district has been apparent for some time, but producers continued to overproduce and offered material at ridiculously low prices.

At Terre Haute, the Terre Haute Gravel Co. put in production a new 4000-ton per day plant. Irving Bros. Gravel Co. built a new plant at Marion and Beyrer Bros. Co. at Mishawaka. Western Indiana Gravel Co., operating eight plants, reported increased business and is now building a plant at Leesburg. The company is establishing a repair factory for its equipment.

Illinois Production Lower

Drastic cuts in production in Illinois are evidenced, the unstable political conditions within the state being the chief contributing factors. There was comparatively little state construction because funds were lacking and those from the gasoline tax were not available until late in the year. The producers shipping into Cook county, which includes Chicago, were the hardest hit; one large producer reported a decrease of 40% over last year. In some outlying districts where county money was available, conditions were better. The Chillicothe area had its biggest year since 1925, but shipments were made chiefly into neighboring states. The decline in production will probably be from 10 to 15% as compared with 1929. Prices in many localities were completely smashed, due to reckless price-cutting from large producers. In the Chicago territory, prices were from 15 to 20% under those received in 1929. Better conditions for 1930 are not expected, for the financial difficulties of the state, and of Chicago, appear to be far from settled. Some important new construction is developing, but slowly.

The Coogan Gravel Co. started operations at a new plant at Chillicothe. The Consumers Co. extended its operations through purchase of the Central Lime and Cement Co. and the Wisconsin Lime and Cement Co., both these companies operating sand plants supplying the Chicago district. Another Chicago sand producer stepped into the retail business, the John N. Bos Co., opening a new $150,000 retail yard. The McGrath Sand and Gravel purchased new property at Mackinaw, and the North Shore Material Co. purchased the J. W. Peters Sand and Gravel Co., Burlington, and is to develop new areas at Libertyville. Superior Sand and Gravel Co., a new concern, is to build a plant at DeKalb.

The outstanding new plant in the district was that of the Material Service Corp., Lockport, Ill., an all-steel and concrete plant, designed to produce 500 tons per hour. The entire product of this plant is shipped in special Diesel-operated self-unloading boats of a design which permits passage under the low bridges in the city of Chicago. This plant was described in Rock Products.

Conditions in Wisconsin, except in Milwaukee, were little different than in 1928; a few plants reported increased business with slightly lower prices. In Milwaukee, construction fell off to so large an extent that material was offered at radical price reductions over that established by the co-operative marketing association. A fair year is looked for in 1930 with little price change.

Early in the year the Mineral Aggregate Co-operative Association was formed, its

chief purpose being to act as a central distributing organization for the aggregate producers serving Milwaukee. At its inception 20 producing concerns operating 30 plants and retail yards were members. Within a few months, trouble started brewing, and at this time the association has suspended activities.

New plants were built by the Janesville Sand and Gravel Co. on a 60-acre tract at Janesville; the Lannon Sand and Stone Co. at Menominee Falls; the Prairie Sand and Gravel Co. at Prairie du Chien, where new acreage was acquired. The Iron River Sand and Gravel Co. is projecting a plant at Moon Lake, and the Pacific Sand and Gravel Co. made several improvements to its Portage operation. The Wisconsin-Wilcox Gravel Co. did not operate its Clinton plant this year; this plant had a production of about 50 cars per day in 1928. The Elkhart Sand and Gravel Co. purchased the plant and holdings of the Moraine Gravel Co. at Plymouth and changed its name to Elkhart-Moraine Sand and Gravel Co. The acquired plant was put in operation in June, 1928. The Maribel Sand and Gravel Co. installed a small plant at Maribel.

Considerable activity was evidenced in Missouri. Plants about LaGrange had record production, shipping a good proportion into Iowa. Missouri's $75,000,000 road bond issue, $7,500,000 of which was available this year, stimulated production. For 1930, $15,000,000 from this source besides gas tax money is available, hence an excellent year appears in sight. In some territories, prices were up; in general the price level was about that of 1928.

Two large mergers in the St. Louis district by which the Standard Materials Corp. and the Central Sand and Gravel Co. were formed. The Missouri Gravel Co. completed its new 1500-ton plant at Reading and now the company is planning to put up another large plant at La Grange on deposits leased from the state of Missouri. The Denton Sand and Gravel Co. after extensive improvements to its Pacific plant, increased its output to 50 cars per day. The T. L. Wright Lumber Co., operating two other gravel plants, completed a new plant at Doniphan, equipped with 2-cu. yd. cableway excavator. One large operation is projected, that of the Phoenix Sand and Gravel Co. at Bagnell. Plans call for a modern 100-car per day plant on the Osage river to fill a 1,600,000-cu. yd. contract for the Union Electric Co.'s new power project. Two 600-hp. Diesel-electric units will be installed to furnish power. M. E. Gillioz is building a 50-yd. per hour plant at Springfield. The Cooley Gravel Co., Chillicothe, completed a 1500-ton plant.

Trans-Mississippi States

Minnesota. Minnesota reports indicate production and prices about the same as last year. Increase in the gas tax from 2 to 3 cents has brought a 1930 program of road construction double that of 1929; this will probably better conditions.

The Becker County Sand and Gravel Co. purchased the holdings and plant of the Detroit Gravel Co., Detroit Lakes. Another J. L. Shiely Co. railway ballast plant, to supply material for the Great Northern Railroad, is under construction at Little Falls.

Iowa Producers Active

Practically all producers in Iowa showed increased production. Indeed, many plants because of Iowa's extensive road program were forced to increase capacities at the close of last year, anticipating demands for material this year. The continuation of road construction and the satisfactory settlement of farm relief predicates an even better year in 1930. Prices were somewhat lower, but recently new contracts at better figures are reported to have been consummated.

The Eddyville plant of the Iowa Sand and Gravel Co. (now owned by the Concrete Materials Corp., Waterloo), was rebuilt early in the year after early spring floods necessitated repairs. Changes made to the dredging equipment included installation of two 40-ft. ladders with "Swintek" cutters and a 10-in. pump with additional electrical equipment. Production was about doubled by the improvements so that now about 50 cars per day are shipped. Some activity about other smaller plants in the state were noted. The Hahn-Muscatine Gravel Co., operated under receivership for the past two years, was sold at bankruptcy sale for $16,000. The Northern Sand and Gravel Co. purchased the deposits, comprising 80 acres on Muscatine Island and buildings for $9000, and W. G. Block Co. the equipment for $7000. At Lake View, the Le Grand Limestone Co. put a modern 1500-ton per day plant in operation. Dragline excavation and rail haul to washing plant is used. The company also has a small movable plant which when occasion requires it loads on a gondola car and carries to any point in the pit.

Eastern Nebraska producers operating near Fremont, the nearest worthwhile deposits to southwest Iowa, were quite busy. The many plants in the district made for low prices. Fair volumes with lower prices were reported in Oklahoma, but with $16,000,000 available for roads in 1930, the state is to launch a larger construction program.

The Lyman-Richey Sand and Gravel Co. expanded its operations in the Omaha district so that it is now operating 23 plants. The company built a new plant at Fremont, which is typical of others it operates at that place; it is of all-steel construction, movable, and has stationary screens, particularly adapted to the conditions in the district (see ROCK PRODUCTS, August 3). A new company, the Platte Sand and Gravel Co., was projected to work deposits at Leshara, near Fremont. The LeGrand Limestone Co. purchased 40 acres at Ashland and announced plans for a gravel plant.

The Schellberg Fremont Sand and Gravel Co.'s new plant, a 10-in. dredging operation, one of the most modern on the Platte river, went into production early in the year.

The Blue Rapids Sand and Gravel Co., Topeka, Kan., opened a new pit and installed equipment including a steel dredge. A fleet of 5-ton Dodge trucks was added by the Victory Sand and Stone Co., Victoryville.

The Arkansas Sand and Gravel Co., subsidiary of the Tennessee-Arkansas Sand and Gravel Co., completed a new $75,000 plant, replacing the Arkadelphia Gravel Co. About 30 cars daily are produced. Another new 25-car plant was put in operation at Camden by the Standard Gravel Co. At Arkadelphia, the Arkadelphia Sand and Gravel Co. made extensive plant and dredge improvements. The Moberly Construction Co. put a 10-car per day plant in service. The Arkansas Power and Light Co. included a 1500-ton plant at Little Rock.

Southwestern States

This territory has experienced its best year, returns from producers indicate. Practically all the plants in Texas had increased production; an average increase of about 10% is a fair estimate. Business is reported as having been quite good and just as good is expected next year. Heavy rains in the spring slowed up production but rapid recovery was made in the ensuing months. Prices were as last year with some few exceptions which were lower. It is significant to state that Texas production received quite a boost by three new plants which totalled about 200 cars per day.

Significant developments in Texas during 1929 included the merging of Gemmer and Tanner, operating plants at Columbus and Houston, Columbus Gravel Co. and the Beaumont Material and Gravel Co. into the Texas Construction Materials Co. Improvements were made to existing plants and a new plant at Columbus completed. The Enos Gravel Co. spent $75,000 modernizing its Brookshire plant and the Texas Sand and Gravel Co. doubled its capacity at Texand by the installation of a new 30-car per day plant adjacent to the older plant. New storage and distribution facilities were opened at Waco by the Texas company. The Southern Gravel Co., a new company, entered the Austin district with a small plant. The largest plant, 100 cars per day, was put into production near Lubbock by the Panhandle Sand and Gravel Co., a 2000-acre deposit along the banks of the Ouitaque river, said to be the only known deposit of sand and gravel of this size in northwest Texas, is being worked. George R. Humlong and Sons are operating a new 1200-ton per day plant at Bronte, and L. E. Witham a 600-ton plant at Austin. The Fort Worth Sand and Gravel Co.'s new plant at Fort

Worth is producing about 200 tons per hour under novel practice referred to elsewhere in this article.

Rocky Mountain States

General decline in volume with low prices are indicated. Poor demand in Arizona caused a drop of 20% though prices remained the same. Colorado showed a 10% decrease in production, although a 5% price increase in Denver was noted. Production increased about 20% in Utah and 5% in Idaho; prices remaining firm as of last year. For 1930, better demand for material is expected and possibly a slightly higher price.

The Utah Sand and Gravel Products Corp., Salt Lake City, remodeled the plant of the Stauffer Sand and Gravel Co., purchased in 1928. The company installed considerable new equipment, including a cone crusher, a 3-cu. yd. power drag scraper and a 1100-ft. conveyor from the pit to the washing plant. In addition a new and modern washing and drying plant of 1500 tons per day capacity will be built. A small aggregate batcher was installed and the company expects to put in a ready-mixed concrete plant during 1930. Development of a silica sand deposit will also be started shortly.

Pacific Coast States

In Washington, a good year for 1930 is anticipated on account of a $10,000,000 highway program and continuation of good business conditions due to the large oriental trade enjoyed by the cities of Puget Sound.

A new plant was constructed at Steilacoom by the Glacial Sand and Gravel Co. securing its raw material from bank deposits similar to those of the Pioneer Sand and Gravel Co. This new plant is one of the most economically operated in the Northwest, having a capacity of 350 tons per hour, using draglines for excavation and belt conveyors for transporting from the bank to the washer plant. Both salt and fresh water are used for washing. Screening is done with two sets of Gilbert screens.

The Pioneer Sand and Gravel Co. installed a new 4-yd. electric shovel during the year and a portable conveyor unit now 400 ft. but ultimately 700 ft. long, for use as a primary transportation unit. This conveyor delivers to a hopper serving the old incline hoist.

Conditions in Washington State were a little better than in Oregon, but production declines of 30% in the Seattle district with prices 15% lower were reported. Producers in the state have given up the idea of carrying on capacity operations in the hope of selling the material at low prices just to keep going.

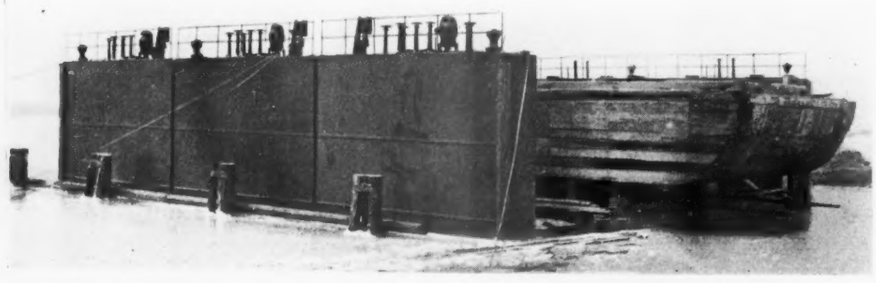
Oregon production was away off, particularly in the Portland district; three large producers report an average decline of 35% wiht accompanying lower prices, in one case amounting to 10% under the 1928 figure. This state has seen bitter gravel wars in past years in which prices were slashed to almost nothing—one year sand went begging at 10 cents a ton.

Industrial conditions in Oregon were such that there was very little evidence of new plant construction. One new producer was reported in Oregon, the Wilcox Sand and Gravel Co., which installed a small plant at Grant's Pass, principally for railroad ballast.

In California, Graham Bros., Inc., expanded through purchase of the Livingston Sand and Rock Co., El Monte, and made notable improvements at its Lomita sand plant. The company has completed a new plant in Orange county. Edward Sidebotham and Son bought out the Hollingsworth Sand and Gravel Co., Los Angeles, and are now building a new plant at Lomita, similar in design to the one it operates there but double the capacity. The Escondido Rock and Cement Co. established a modern plant in Escondido.

The Blue Diamond Materials Co. built a new plant at Roscoe; the novel features of the plant are briefly described elsewhere in this issue and a complete description will appear in an early issue.

The outstanding event of the year was the formation of the Pacific Coast Aggregates, Inc., San Francisco, and the Consolidated Rock Products Co., Los Angeles, referred to elsewhere in this article. Another important merger concerned the San Joaquin valley producers, the Service Rock and Gravel and Grant Rock and Gravel Co. combining.



New steel-pontoon, floating dry-dock recently put in operation in Manor lake, near Tullytown, Penn., by the Warner Co. The dock will be used to service the company's floating equipment in use at its nearby sand and gravel operations

Canada

Business in the Ontario district was reported as satisfactory; one producer states production increased 25% during the year. Prices were substantially lower than in 1928, reductions of 10 to 25% being reported. Outlook for 1930 is regarded as promising.

A notable number of consolidations took place in 1929, the principal one resulting in the formation of the Standard Paving and Materials, Ltd., Ottawa, combining under one management large contracting interests and the extensive sand and gravel plants and properties of the Consolidated Sand and Gravel, Ltd., and the National Sand and Gravel, Ltd. The Canada Paving and Supply Corp., Ltd., combined a number of paving and contracting firms, building supply dealers and sand and gravel producing operations of the Windsor Sand and Gravel Co., Ltd., at Windsor, Ont.

In western Canada, Gilley Brothers, Ltd., who bought the Freshwater Sand and Gravel Co. at New Westminster last year and are completing plants for development of the Hill Sand and Gravel Co., opened a small truck-delivery plant at New Westminster.

Incorporations

During 1929, a summary of incorporation notices published in ROCK PRODUCTS indicates 153 new companies with a total capital of $21,026,000. A comparison with 1928 is given below:

INCORPORATIONS REPORTED IN ROCK PRODUCTS DURING 1929

State	No. of Inc.	Total
Arkansas	5	$ 210,000
Connecticut	3	180,000
Florida	2	20,000
Illinois	7	4,400,000
Indiana	12*	492,000
Iowa	1	50,000
Kansas	3	135,000
Kentucky	3	2,300,000
Louisiana	5	162,000
Maryland	1	20,000
Massachusetts	7	3,300,000
Michigan	9	390,000
Minnesita	1	300,000
Missouri	2	130,000
Mississippi	5	375,000
New York	19*	1,598,000
Nebraska	2	95,000
New Jersey	18	1,775,000
Ohio	17	1,357,000
Oklahoma	2	70,000
Oregon	3	100,000
Pennsylvania	3	305,000
South Carolina	1	100,000
Tennessee	2	70,000
Texas	8	1,422,000
Virginia	1	50,000
Washington	2	1,025,000
Wisconsin	9	595,000
Total, 1929	153*	$21,026,000
Canada	9	$2,020,000
Total, 1929 (incl. Canada)	162*	$23,046,000
Total, 1928	162*	$ 6,993,000
Total, 1929 (Canada)	7	$ 2,360,000

*Includes companies not giving monetary value of incorporation.

Gypsum Products in 1929

DURING the past two years all of the gypsum producers have been involved in the most severe price war ever encountered in the industry, it is said. During this conflict the price structure became so impaired that many companies were forced to meet competitive prices even though it frequently entailed a complete loss of profits, or worse.

The price cutting and general disorganization of the industry became so bad during the early part of 1929 that members of the industry, in self-defense, were forced to act to correct conditions, and as a result of this action the entire industry operated on a more sound basis during the last three months of 1929. Prices were advanced on wallboard and plaster to a schedule that was materially higher than earlier in the year.

According to reports, all of the important producers in the gypsum industry have entered into a license agreement which will effect stabilization of prices on certain gypsum products for many years to come and will prevent recurrence of such price wars in the future.

With a stabilizing of prices, gradual during the first part of 1929 but dropping off at the approach of the winter months, monthly productions were lower than for many years. The lowering of sales can be traced to withdrawal of funds incidental to the recent market crash, with the gypsum industry hit perhaps harder than any of the other building material producers, as the falling off in those type of structures using plaster was more pronounced than in any other field of construction.

It was reported that the series of patent litigations in which the United States the effect of the settlement of these suits tled. The patents in question involved only the manufacture of wallboard, but the effect of the settlement of these suits is expected to further stabilize the gypsum industry.

Notable Large Plants Built

Construction of new plants during 1929 was limited to those completed by the United States Gypsum Co. This company placed its Charleston, Mass., plant in operation on March 15 and the East Chicago, Ill., plant started on July 15. It is expected that the new Detroit and Philadelphia operations of this company will start on production shortly. Descriptions of these new plants, using the rotary kiln for calcining, were published in the August 3 issue of ROCK PRODUCTS. They are notable not merely for size but the fact that each manufacture gypsum products from raw materials brought by water from distant sources.

The two eastern plants of this company will receive their rock from Nova Scotia boats operated by the Gypsum Packet Co., a subsidiary of the main company. A new 6400-ton capacity boat was placed in operation during the past year. However, not all the gypsum for the United States Gypsum Co.'s new plants will come from Canada, as it is expected that a larger yearly tonnage will come from its Alabaster, Mich., property.

From the Michigan holdings gypsum rock is supplied the new plants at Chicago and Detroit. The rock is reclaimed from an open pit, crushed, and, because a loading dock is made impracticable by the shallowness of the water, is conveyed by means of an aerial tramway to a loading crib about a mile and a quarter off shore in Lake Huron.

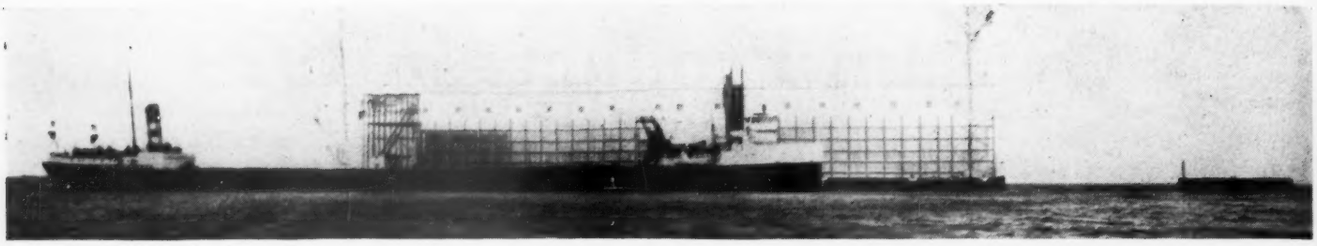
The upper seam of the quarry, which is now being worked, averages 20 ft. in thickness. The quarrying process consists in first removing 15 to 40 ft. of clay and shale overburden for a width of 50 to 120 ft., according to the disposition of the spoil, and piling it on a section of the quarry floor from which the gypsum has been removed.

The exposed gypsum bench is then drilled with tripod-type drills, and the holes, which are 2 in. in diameter, are loaded with a special dynamite and exploded electrically.

Bucyrus shovels load the rock into 15-ton cars, which are hauled by steam locomotive to the main crusher building, where it is crushed by a Traylor gyratory crusher fed by a pan conveyor. By a bucket elevator and belt conveyors the crushed rock is taken to the lake shore bin, a cylindrical steel tank of 1000 tons capacity. Rock is drawn from the bottom of this bin through air-actuated chute gates directly in the tramway buckets.

The tramway is supported by eight steel towers, 60 to 80 ft. in height, and 750 ft. apart from center to center. The steelwork, which is of regular tension tower construction, is anchored to stone and concrete bases, which in turn rest on cribs constructed of 12-in timbers placed

Loading end of the aerial tramway at Alabaster, Mich., owned by the United States Gypsum Co.



Boats loading gypsum rock at the receiving crib on Lake Huron, near Alabaster, Mich.

log-cabin fashion and filled with stone to the water level.

At the top of the towers are two fixed track cables, anchored at the shore end and having tension-regulating weights at the other end. Suspended from the cables by means of tandem trucks are 80 buckets, each of 2 tons capacity.

Power for the tram is furnished by a 60-hp. electric motor. The motor drives a large grip sheave, which, in turn, drives a ¾-in. traction rope of special design. The loaded buckets are automatically dispatched on this traveling traction rope at a uniform distance apart. At the loading bin ,which rests on a large crib, the buckets are discharged by means of a tripper, which engages a latch on each bucket as it progresses. The empty buckets return to the shore bin on the continuous traction rope, which travels around a 16-ft. bull sheave on top of the loading bin. At the shore end the buckets disengage from the cable, traverse a circular track, to be again loaded and automatically dispatched.

In loading the rock on the boats it is first moved from the bin to a drag scraper and conveyed up two inclined ramps, which discharge into hoppers, each of which feeds a shuttle belt. These belts are on 48-ft. centers, which takes care of the majority of lake boats.

Another of this company's plants placed in operation during the past year was at Midlands, Calif. This new plant uses the kettle process and will, with the company's Arden, Nev., plant, supply its West Coast markets.

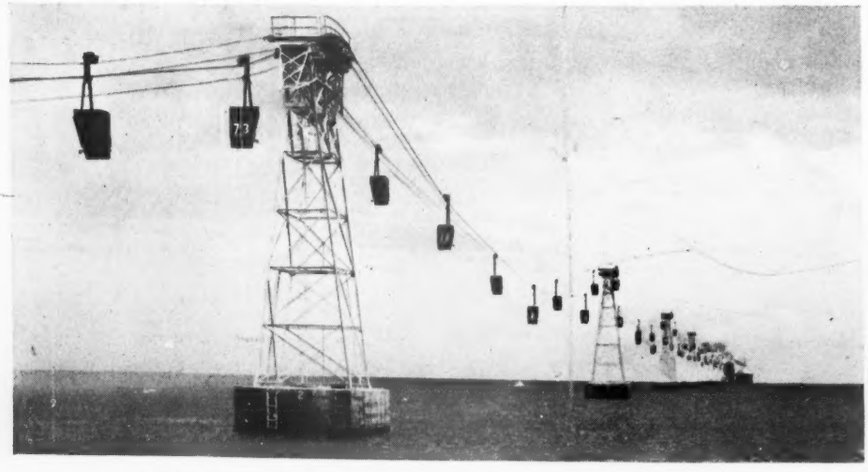
The International Gypsum Co. was reported to be considering the erection of a calcining plant at Savannah, Ga., getting its rock requirements from Canada, but to date construction work has not been started.

Byproduct Gypsum Plants

In the byproducts field there were interesting advances made, and though these were of small tonnage compared to the total, they were illustrative of the trend in the chemical industry to utilize what were previous waste products. The entry of the chemical and its allied industries into the building material field is worthy of the present producers' attention.

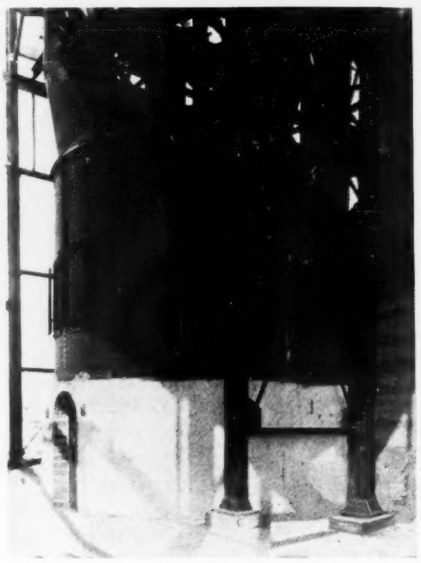
The United States Phosphoric Products Corp., Tampa, Fla., is a subsidiary of the Tennessee Copper Co., which operates a copper smelter at Ducktown, Tenn., and secures as a byproduct sulphuric acid. As an outlet for some of the acid produced in Tennessee, the parent company years ago organized the United States Phosphoric Products Corp. and established a plant about 20 miles from Tampa, Fla., to manufacture superphosphates. The company purchases all of its phosphate from the different phosphate mining companies that operate east of that city and conducts no mining operation there of its own.

The production of phosphoric acid from phosphate rock consists, in essence, of treating the crude calcium phosphate with sulphuric acid, producing phosphoric acid and gypsum.



Aerial tramway for loading gypsum boats on Lake Huron

The phosphoric acid is removed and the residue, which is mostly calcium sulphate plus 2 molecules of water, is thoroughly washed to remove any remaining free phosphoric acid. The sludge is then flumed



Calcining kettle at Tampa, Fla., byproducts plant

to settling ponds, and until the establishment of the gypsum calcining plant was considered waste material.

For several years the United States Phosphoric Corp. has been experimenting in an attempt to convert this gypsum residue, which contains 80% to 85% $CaSO_4 \cdot 2H_2O$ to gypsum stucco, and from time to time news items have been published regarding the work; but it was not until late in 1928 that actual construction of the calcining plant was started, and the plant is now in operation and is producing blocks, tile, etc., of excellent quality.

The process as developed is about as simple an operation as one could imagine, as no crushing or pulverizing is needed. The semi-dry sludge already has a fineness of 83% to 85% through a 100-mesh screen and 80% minus through 150-mesh, making further grinding unnecessary for the class of stucco being produced.

The sludge on standing in the stock piles drains of excess water, but by nature is still a mud and contains 20% to 25% physical water, as well as the addi-

Transfer station in mine of Victor Plaster, Inc.

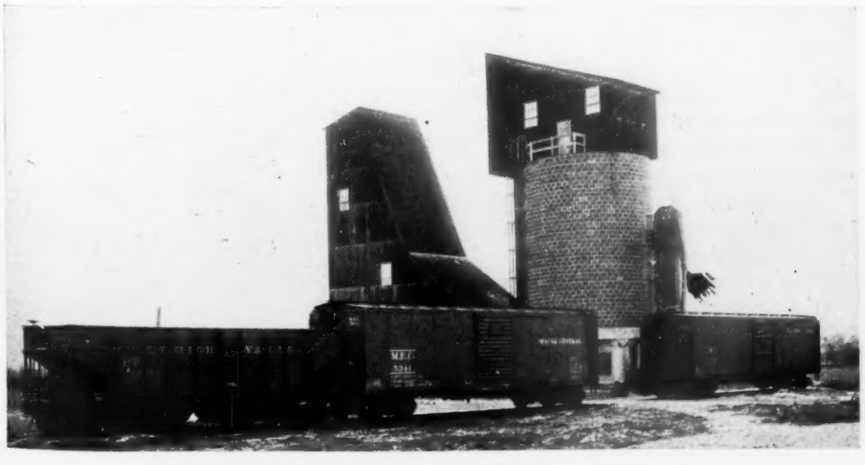
Mining gypsum in a New York operation

tional chemically combined water associated with its chemical equivalent of gypsum.

This "mud" is fed without previous drying to a small hopper feeding a 24-in. belt conveyor which elevates the material through an angle of 20 deg. directly over the single, 10-ft. Ehrsam calcining kettle. where the mud is chuted direct into the kettle. Oil burners are used for firing. The kettle is set with the usual Ehrsam setting with four flues, two above two, and with a pressed steel bottom, and is expected to calcine 100 tons per day.

After calcining, the stucco is discharged to the single hot pit, which is emptied by four parallel screw-type emptiers that discharge to a cross screw serving the bucket elevator. The bucket elevator discharges to a short screw conveyor that delivers the stucco to a steel, circular storage bin which sets directly over the mixer.

The storage bin delivers by gravity to a Dunning Boschert mixer, where sufficient water is added to make a mortar of proper consistency, which is passed by gravity to the Her-Born "Junior" type block machine. The blocks and tile are air dried.



New gypsum crushing plant of the Victor Plaster, Inc.

Aluminum Ore Co.'s Byproduct Plant

Last year in our annual review number we mentioned that the Aluminum Ore Co., East St. Louis, Ill., was experimenting with the production of gypsum from a byproduct. The experimental work was finished and a plant is now under construction and is expected to be in operation shortly.

In the preparation of artificial cryolite, a material used as a flux in smelting of aluminum ores, bauxite is leached with hydrofluoric acid, and to prepare this acid, calcium fluoride is leached with sulphuric acid, giving off gaseous H_2F_2, leaving a residue of anhydrite. The product, anhydrite, is in the form of a damp cake containing small amounts of calcium fluoride, sulphuric acid and hydrofluoric acid. The problem then resolved itself into the hydration of the anhydrite, removal or neutralization of the acid residue, and calcining the residue to form stucco. That this has been successfully accomplished is evident from the fact that the company is carrying out plans for a commercial gypsum products unit.

The Linden plant of the Structural Gypsum Co. was expanded during 1929 to five kettles and is manufacturing "Gypsteel," neat and sanded plasters, partition tile, precast floor, ceiling, and roof slabs. There were no expansions at the company's Akron, N. Y., plant as was reported.

General

There were two incorporations to produce and deal in gypsum and gypsum products, with neither company intending to manufacture wallboard or stucco. There was one bankruptcy proceeding instituted, that of the Universal Gypsum and Lime Co., which is still in operation under the receivership.

New Gypsum Mine Opened in 1929

A new industry has been developed during the past year with the opening of the gypsum mine of Victor Plaster, Inc., at Victor, N. Y., and the marketing of its product, which began in March, 1929. This company is specializing in crushed gypsum rock for use as a retarder in portland cement.

The construction of this plant, which is characterized by the simplicity of its operation, being practically one-man control, and by its facilities and adaptability for enlargement and improvements, was completed in December, 1928, and started operating early in 1929.

Mining was started north and south of the shaft at 110 ft. in January of this year. The shaft is a four-compartment, having two cage compartments, air ventilator and stairway. The room and pillar system is employed, pillars 15x30 ft. being left for support at intervals 26 ft. in one direction and 18 ft. in the other. The gypsum bed at this level runs 6½ ft. in thickness, dipping about 2%. A unique feature of this mine is its roof, which is of limestone with a thin layer of black dolomite, in a wave-like formation. Geologists and chemists who have examined the formation have stated it must have been formed by the action of the water when the gypsum was formed. The roof continues

throughout the entire stratum and is conducive to economical operation, as very little propping is necessary. Pumping is another item on which quite a saving is effected, water being taken care of from the bottom by a 7½-hp. pump.

Drilling is done by electrically-driven, rotary auger drills, with three Scranton machines. An Ingersoll-Rand air compressor furnishes air for the Jackhamer drilling, very little of which is required. A blacksmith shop on the premises takes care of all drill sharpening, a Weldit outfit being used to stellite the drills. The use of a hard surfacing metal on the cutting edge of an auger bit is of unusual interest and will bear further investigation by the producers. The blasting is done with 20% dynamite and "Clover" fuse and no caps.

The rock is loaded into steel cars of about 2 tons capacity each. These cars are pushed on tracks to the automatic self-dumping cages, hoisted by a 50-hp. engine and automatically dumped into a weigh hopper from which the rock is delivered by means of an apron conveyor into a single-roll Pennsylvania crusher, having a capacity of 60 tons per hour and driven by a 75-hp. motor. From the crusher it is elevated to a rotary screen 48-in. by 14-ft., above the silo, where it is screened to 1½-in. and under. Oversize pieces are returned by a tailings return belt to the crusher. From the silo, the rock runs through a chute to a Schaffer poidometer, which automatically weighs and delivers into a loading elevator, near the track, which raises it so it can be readily spouted into gondola cars. An Ottumwa car loader is used for loading box cars.

Dr. C. A. Huber is president of the company, T. M. Stewart is secretary and treasurer, and S. Firestone is vice-president and consulting engineer, all of whom are of Rochester. Charles Spengler, superintendent, erected the plant.

Canada Gypsum to Erect Plant in Calgary

The Canada Gypsum and Alabastine, Ltd., is to establish a plant in East Calgary, and it is announced by W. E. Armstrong, of Winnipeg, western manager of the company, that excavations for the buildings will be started at once. A site of eight acres has been secured.

The Canada Gypsum is a large manufacturer of gypsum and lime products, with gypsum products mills at Caledonia and Lythmore in Ontario; Montreal, Que.; Winnipeg, Man., and Port Mann, L. C. Lime products mills are situated at Paris, Elora and Teeswater in Ontario. The company added the Standard Lime Co., Ltd., Quebec, to its already extensive operations during the year. The Canada Gypsum and Alabastine, Ltd., also bought the Beachville Lime and Stone Co., the Christie Henderson Co., the D. Robertson Lime Co., the Toronto Lime Co. and the Wellington Lime Co. The purchased firms are all located in the province of Ontario.

The initial construction program for the East Calgary plant is to cost between $140,000 and $150,000, it is stated, and the products will be wall plaster and gypsum tile. Later it is intended to increase the scope of the plant, and a plasterboard mill will be one of the first additions.

The raw materials for Calgary's new gypsum industry are to be obtained at the outset from the Portland quarries near Kamloops, B. C., but the company plans to develop its quarry near Wardner, B. C., in the Crow's Nest Pass, in the near future.

The Atlantic Gypsum Products, Ltd., another large producer, took over the property of P. M. O'Neil Gypsum Co. some time ago. The quarry is located about three miles from Cheticamp, N. S., and at least three square miles of gypsum-bearing land is held under lease. Operations during the year were confined mainly to construction work and development. A crusher of large capacity was installed and some of the crushed gypsum was shipped to the United States. A new power plant and shipping pier are being added to the existing property.

Other Developments in the United States

The United States Gypsum Co. purchased the Niagara Gypsum Co.'s plant at Oakfield, N. Y.

The Structural Gypsum Co. was not sold to the American Cyanamid Co., as reported. The American Cyanamid Co. in October, 1927, purchased a substantial amount of the new stock which was issued at that time for the purpose of financing the construction of the Linden, N. J., plant, and has increased its position as a stockholder in the corporation as subsequent stock issues were made to finance further expansions. The American Cyanamid Co. has not, however, acquired all the stock of the Structural Gypsum Co. and the latter company continues to operate as a separate organization.

Anticipating a return of money to the building industry as a result of the market crash, the Best Bros. Keene's Cement Co. has just completed a comprehensive plan of plant additions and enlarging its sales force.

The California Stucco Products Co. of Los Angeles completed a new plant and office and entered the field as manufacturers of gypsum lath.

At Finlay, Tex., the Texas Gypsum Products Co. is reported to be building a plant for the manufacture of wallboard, tile and other gypsum products.

The Montana Gypsum Products Co., Butte, Mont., is reported to have sold its gypsum holdings to Japanese capitalists.

Proposed Tariff

Early in 1928 a group of domestic producers brought proceedings through the United States Treasury Department to classify importations of gypsum, entering as crude and therefore free of duty, as "ground gypsum" and therefore subject to a duty of $1.40 per ton. On June 12, 1928, the Treasury Department ruled that gypsum then being imported as crude came under the classification "ground gypsum" and was therefore subject to duty. The ruling was protested and on July 20 testimony was submitted by importers, and a month later the Treasury Department announced that it had decided to apply a duty of 30% ad valorem. On February 4, 1929, the United States Treasury Department again, after a thorough investigation, ruled that crushed gypsum should remain on the free list.

During the year, at hearings before the ways and means and finance committees of congress, a group of domestic producers requested that a duty of $3 per ton be placed on crude gypsum in the pending tariff bill, with corresponding increases for ground gypsum, calcined, wallplaster and other gypsum products. Retention of gypsum on the free list was advocated by importers. The tariff bill is still hanging fire.

Association Activities

At a trade practice conference held at the Waldorf-Astoria Hotel, New York City, 21 resolutions were adopted by the committee to be submitted to the Federal Trade Commission. Later it was announced that the commission gave its affirmative approval of 13 of these rules and accepted the remaining eight as expressions of policy of the trade.

New Products

There were several new products introduced on the Pacific Coast during the past year that should be the start of an increasing use of gypsum, when sufficient publicity has been given these products to make their value and utility more apparent to the general public. Among these developments might be mentioned a wallboard that folds to conform to structural needs. This was a development of Kendall and Delaney of Los Angeles. Gypsum lath that folds and is more or less flexible so as to make its application a simple matter to intricately designed interior structures is a novel product of the California Stucco Products Corp., Los Angeles. The development of a method of fastening gypsum plaster board to steel structural members by the methods devised by Mutual Income Properties, Inc., of Los Angeles; the development of acoustical wallboards; a gypsum acoustical duct that prevents transmittal of sound through ventilator shafts; artificial travertines; the invention and use of a method of casting concrete objects in

porous plaster molds; gypsum in the movie industry, and other new uses and manufacturing methods, all of which will be described more in detail in forthcoming issues of Rock Products.

The manufacture of white cement having excellent cementing properties from anhydrite is receiving considerable attention and points the way to the economical use of enormous tonnages of now waste material. Cements made by patented processes develop strengths of from 500 to 550 lb. in 24 days and 800 lb. in 28 days and are of sufficient hardness to take a high polish, and it is said they can be calcined at fuel costs comparable with present practices in calcining ordinary gypsum.

In the Middle West and East the manufacture of gypsum lumber made substantial headway. The plant of the Rockwood Gypsum Lumber Co., East St. Louis, Mo., manufacturers of this product, was described in the March 30 issue of Rock Products. Unquestionably the use of gypsum as a substitute for lumber in the construction of forms for reinforced concrete will make more rapid strides in the future when the building industry realizes the superior strengths obtained in concrete when a gypsum mold is used, on account of the mold absorbing the excess water and thereby reducing the water-cement ratio.

During the past year official cognizance of the value of the gypsum inhalations has been taken by the medical profession, apparently, through extracts of an article by H. Hennes, appearing the *Journal* of the American Medical Association, under date of May 18. The practically total absence of tuberculosis and other lung infections among gypsum workers has been generally known in the industry for many years, and attention has been called to it in Rock Products in many articles during the past 12 years.

Some Developments in the Gypsum Industry During 1929

By Frank A. Wilder
North Holston, Va.

LIKE MOST American industries, the gypsum industry has not yet been stabilized in many of its aspects and the year just drawing to its close has seen many changes. Competitive conditions have been particularly difficult and the low prices that have prevailed for all gypsum products will be reflected in the balance sheets of all producing companies. As the year draws to a close these conditions, which have been bad for two years and were at their worst when the year opened, show some improvement, and those mills that have reasonable cost sheets should show a fair profit during 1930.

Building Outlook

Conditions that will govern the building trade during 1930 are confused to some extent. Some influences have recently appeared that will favor residential construction, while other forces that have been operating to retard construction will continue to be felt for some time to come.

The building shortage left by the war has been met by the construction of the intervening years. Building that would otherwise have been started in 1929 was held back by the high price of money. Tonnage of gypsum for the early months of 1930 will fall below that of the preceding year. The output of gypsum mines and quarries in 1929 was probably less by from 5 to 10% than that in 1928 and 1927. Exports of gold which have assumed considerable proportions during the last months of 1929 will probably continue until the spring or summer of 1930, but they are not apt to assume alarming proportions in the creation of a money shortage; and the demand for gypsum products should show a moderate increase by the fall of 1930.

New Mills and Improved Products

A number of new mills of the latest design and of marked efficiency began production in 1929 and most of these mills are located near large markets. Older mills have been improved in many instances.

The demand for wall-board has steadily increased, but the amount of gypsum that enters into a bungalow where wall-board is used is less than that required when lath and three layers of plaster is the method of construction.

"Gyp-lath" is becoming more popular each year and, since joints can be broken as readily as when lath are used, this material is taking the place of both wood lath and plaster-board. The dangers of cracking and lath buckling are eliminated, and from the price standpoint gyp-lath can meet the competition of the older materials. Here again, however, the amount of gypsum required is less than the amount required for a scratch coat on wood lath.

Although the use of gypsum wall-board and gyp-lath tend to decrease the tonnage of gypsum calcined, they are, nevertheless, important factors favoring the profitable growth of the gypsum industry. They have a general tendency to concentrate the industry in fewer hands since the mills for their manufacture are expensive and the construction and operating technique are somewhat difficult.

Tariff Situation

During most of the year American producers have either hoped or feared that Congress would place a tariff on crude gypsum which at present comes in duty free. A number of large mills on the Atlantic and Pacific coasts are dependent for their supply of raw material on Nova Scotia, New Brunswick and Mexico. Most of this gypsum is run through a crusher at the quarry for convenience in loading and unloading the ships or barges that are used in transportation. Two years ago the permanent tariff board of review decided that gypsum that had passed through a crusher was equivalent to ground gypsum and should pay a duty of $1.40 a ton. This decision was vigorously protested by importers and after a long and apparently thorough investigation the board reversed its decision and in consequence crushed gypsum continues to enter the country duty free. During the special session of Congress persons capable of presenting both sides of the controversy have appeared before congressional committees. At the time that this article was written (December 16) no conclusion in regard to a duty on gypsum had been reached.

By-Product Gypsum

Considerable progress in the treatment and use of by-product gypsum was made during the year. Several years ago the Rumford Baking Powder Co. succeeded in separating and utilizing in the form of gypsum blocks the by-product gypsum that was formed in its mill in the making of soluble phosphate. The American Cyanamid Co., part owners of a large plant at Linden, N. J., has made a large investment in mill and machinery to mechanically extract practically all of the water from the large stream of gypsum which is constantly coming from its phosphate plant in the form of a slurry, and in calcining and preparing this gypsum for the market in various forms. It is reported that this company has succeeded in making a plaster that works smoothly under the trowel, something that has not been accomplished previously where synthetic gypsum was used. A phosphate plant at Tampa, Fla., is producing considerable by-product gypsum which is manufactured into gypsum tile.

Prospective New Uses

The use of gypsum and anhydrite in the concentration of atmospheric nitrogen and the manufacture of fertilizers has not been attempted as yet on this continent, but in view of the successful operation of such plants in Germany and England the question naturally arises whether American conditions are in any way peculiar and whether an expansion of the industry along this line may at any time be expected. Chilian nitrate

furnishes the same fertilizing elements and the boat haul from Chili to the southern states, where most of the fertilizer is used, is somewhat shorter than that of Europe. This, however, seems to be too small an item to be determining factor in the situation. In view of the attitude of the government toward the farmer, Chilian nitrate and similar fertilizers need have no fear of a tariff wall.

Nova Scotia's abundant anhydrite beds at or near the sea coast, with cheap Canadian water power not far away, and water transportation to the more important American markets as well as to the markets of the world, make it likely that in the course of time this important phase of the gypsum industry will be developed on the American continent, as several companies are experimenting in that field.

Sand-Lime Brick in 1929

APPARENTLY there was a drop in production of sand-lime brick of between 20% and 25% as compared to production in 1928. This drop can be attributed, in a measure, to the falling off of construction work in the automobile manufacturing centers of Michigan, as the state, in 1928 produced approximately one-third of the total production for the United States. Complete statistics for 1928 on the production and prices of sand-lime brick were published in the June 22 issue of Rock Products.

A comparison of plant prices in December, 1928, with those of December of 1929 following, shows very little change, but what changes are notable were downward, with one exception, that being in Detroit where prices improved about 75 cents per 1000. New Jersey, during this same period had a drop of $2 per 1000; Sioux Falls, S. D., dropped $1 and Toronto, Ont., a similar amount. The highest plant price reported in 1929 was $18 per 1000, at Syracuse, N. Y., and the lowest $8 at Minneapolis, Minn.

With one or two exceptions the plant prices of sand-lime brick were practically stationary during 1929. Atlantic City, N. J., showed a rise in price of $2 per 1000 during the early summer months and Grand Rapids, Mich., also showed an advance of $1.50 during November. There was also a slight rise reported in Jackson, Mich., during November, 1929. Minneapolis was the only district reporting a drop in price, and in that locality serious cuts were made during June, when the price dropped from $10 to $8.25 per 1000 and the following month the price dropped again to $8 and remained at that figure the balance of the year. In Florida the prices dropped about 10% early in the year, but in July returned to their former level before the drop.

Apparently all of the producers expect that 1930 will show as large a production as in 1928, when 41 plants produced 313,553,000 brick. Prices are not expected to drop during 1930, but on the contrary may show an upward trend.

New Plants in Prospect

The Haden Lime Co., Houston, Tex., is making preliminary plans for the construction of a sand-lime brick plant, and will use lime made from oyster shells at its new rotary kiln calcining plant. This company is also a large sand producer in southern Texas.

A second Texas company reported to be planning on constructing a sand-lime-brick plant is the Steger Sand-Lime Brick Co. at Ranger.

The Sand Lime Products Co., Detroit, Mich., enlarged its plant and installed two new Jackson and Church presses and other new equipment during 1929. The San Antonio Sand Lime Brick Co., San Antonio, Tex., made considerable alterations during the past year.

MONTHLY TABULATION OF SAND-LIME BRICK PRODUCERS' REPORTS†

1929	No. plants reporting	Production	Shipments—Rail	Shipments—Truck	Stocks at end of month	Unfilled orders
January	22	10,548,800	1,674,800	6,206,000	16,082,000	7,253,000
February	22	7,431,500	2,954,600	5,942,000	16,973,900	10,665,000
March	21	11,432,855	3,944,652	9,497,929	14,256,168	12,630,000
April	24	16,154,923	4,358,812	13,579,953	14,235,824	11,587,000
May	23	12,969,000	5,658,000	13,107,000	10,561,000	9,188,000
June	24	17,578,000	5,412,000	13,757,000	10,447,000	14,968,000
July	18	16,061,000	4,263,000	12,266,000	8,854,000	14,739,000
August	18	16,838,000	4,684,000	11,615,000	9,714,000	9,925,000
September	18	14,121,000	3,960,000	10,951,000	9,326,000	13,286,000
October	22	17,563,000	5,150,000	10,863,000	12,957,000	12,943,000
November	23	14,011,000	4,956,000	9,938,000	10,854,000	9,708,000
December*	....	14,000,000	3,700,000	11,000,000	12,000,000	11,000,000
Total		168,709,078	50,715,864	128,772,882	.....	.....
1928‡	25	204,934,600	66,913,000	140,478,100	.....	.....

*Estimated from 21 plants.
†This represents about one-half the total productive capacity in the United States.
‡For comparison of 25 plants reporting during 1928.

One of the largest plants built during the year was that of the National Brick Corp. of Long Island City, N. Y. This plant contains eight presses, four rod mills and volumeters and other equipment for a plant of this size. All of the equipment was supplied by Jackson and Church Co., Saginaw, Mich.

Technological

Considerable work was done by the United States Bureau of Standards on the characteristics of sand-lime brick. A brief abstract on the strengths of sand-lime brick was published in the April 27 issue of Rock Products, and in the August 17 issue the results of freezing tests on sand-lime brick by the bureau were published. In the November 23 issue results of measurements of transverse and compressive strengths on bricks from 25 different producers were published in considerable detail, giving the maximum, minimum average and distribution of the values obtained with the relationship between the various factors were recorded.

Producers' Comments

Comments from producers regarding overproduction and the possibilities of restricting production brought out the following interesting replies:

"It might be possible to frame practical rules in co-operation with the Federal Trade Commission so that production might be restricted based on an equitable percentage of capacity and normal consumption."

* * *

"If some producers had used good judgment half of the plants would never have been built. To get these same minds to take a loss willingly is impossible. Furthermore, these so-called gentlemen's agreements do not amount to much unless there are gentlemen."

George B. Hart

GEORGE B. HART, vice-president and treasurer of the Chicago Gravel Co. and the Illinois Sand and Gravel Co., died at his home in Highland Park, Ill., following an illness of several months. Mr. Hart was born at Paxton, Ill., on January 16, 1885, and following a public school education in Chicago attended Northwestern University, graduating in law. He was admitted to the Illinois bar in 1916.

A son of the late James A. Hart, former president of the Chicago Gravel Co. and also for many years president of the Chicago National League baseball club, Mr. Hart came to the Chicago Gravel Co. about 20 years ago as a clerk. He was gradually advanced until he had reached the position he occupied at his death. He was a great traveler, traveling around extensively and in practically every part of the civilized world. In addition, golf and sports were among his hobbies.

Mr. Hart is survived by his mother, Mrs. James A. Hart, a sister, Mrs. C. A. Meyer, and his wife and two children.

Lime and Hydrate in 1929

IN REVIEWING the lime industry for 1929, and for the past few years as well, we are struck by the large number of companies which from year to year report reductions in tonnage. Apparently the bottom was not reached in 1928, but the market continued to sag throughout 1929, and in the second half of the year at a more rapid and sharper rate than during the first half. Reorganization and renewed activities of the National Lime Association, adherence of its members to a code of trade practices and even an awakening of the non-members of the National Lime Association to the needs of the industry are expected to prevent further declines in prices and to gradually reestablish lime in the construction and industrial fields.

In reading the comments of producers in reply to our questionnaires, the word "co-operation" stands out as being uppermost in their minds and indicates willingness; a give and take attitude, to discuss, arrive at and to agree to; and most of all, to *stick to* solutions arrived at by such co-operative discussions.

The lime sold by producers in 1928 amounted to 4,458,412 tons (short) valued at $36,449,635. This represents an increase of about 1% in tonnage and a decrease of 6% in the price over the statistics given for 1927. During the past year indications are that the volume slumped 20% and the price dropped sharply during the second half of the year.

Mason's Hydrate Prices Off

Prices quoted for mason's hydrate were practically $1 per ton lower at the close of 1929 than for the same time last year in the Ohio and Eastern territory. In Alabama, Tennessee and Florida the prices held firmer. On the Pacific Coast prices on mason's hydrate dropped $2 to $2.50 per ton. Prices on finishing hydrates in Ohio dropped $2 per ton, but held firm on the Pacific Coast. Rumors are rife that mason's hydrate has been quoted as low as $6.50 per ton in the Ohio territory, which, if correct, gives a new low for that product.

The following comparison of November prices, taken from the records of Rock Products for 1928 and 1929, shows the price trend for the year:

	Mason's hydrate prices during November	
Location	1928	1929
Carey, Ohio	$ 7.50	$ 6.50
Cold Springs, Ohio	7.50	6.50
Huntington, Ind.	7.50	6.50
Mill Town, Ind.	8.50–10.00	7.50–8.50
Scioto, Ohio	7.50	7.50
Sheboygan, Wis.	10.50	10.50
Wisconsin points	11.50	11.50
Woodville, Ohio	7.50	6.50
Keystone, Ala.	9.00	9.00
Knoxville, Tenn.	9.00	9.00
Ocala, Fla.	11.00	11.00
San Francisco, Calif.	16.00–17.50	14.00–17.00

	Finishing hydrate prices in November	
Location	1928	1929
Carey, Ohio	$11.50	$ 9.50
Gibsonburg, Ohio	11.50	9.50
Scioto, Ohio	11.50	10.50
Woodville, Ohio	11.50	9.50
San Francisco, Calif.	19.00–19.50	19.00

Producers throughout Pennsylvania, New York and the New England States reported a lessening in production of serious proportions and during the second half of the year a recession in prices. Production apparently dropped 15% and prices about 10%. Practically all producers feel that 1930 will show a larger tonnage and a slight increase in price. The unsatisfactory economic conditions in the lime industry in those sections is reflected—fortunately—in the small number of new plants that were constructed.

Owing to a falling off of building in the Midwest, notably in the larger cities of that section, the production fell off sharply, producers reporting from slight percentages of drop to as high as 75% reduction in volume.

Apparently the Ste. Genevieve district in Missouri shipped a larger tonnage this year than ever before, but prices were at a low ebb and have been for the past two or three years. A large amount of lime from this district goes for industrial uses other than construction. Other Southern producers in the Mississippi valley reported a falling off in tonnage. In the South Atlantic States there also was a reduction in volume and in price, although in Alabama, Florida and Tennessee prices were reported to have held firm.

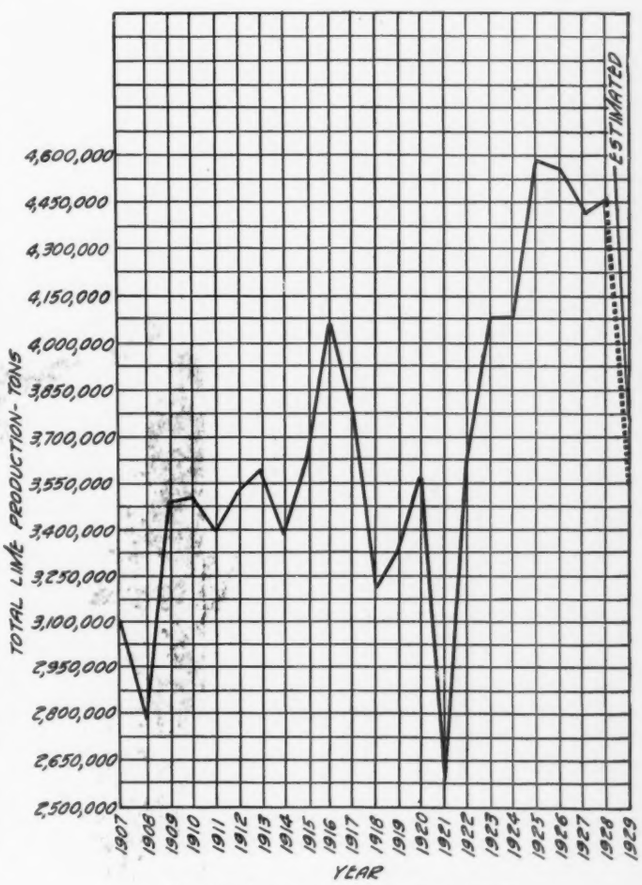
On the West coast there appears to have been a falling off in the production of high calcium limes, although one company made substantial gains in marketing and production of dolomitic limes and enlarged its plant to meet the demand, following its introduction of dolomitic lime on the coast. Prices are reported unsatisfactory, in keeping with the situation in the lime industry generally.

By far the most interesting and outstanding development in the lime industry during the past year was the completion of the plant of the Haden Lime Co., Houston, Tex. A complete description of this operation was published in Rock Products, December 21, 1929. This company has an extremely low production cost for raw material, cheap gas, and is economical as to man power. It is stated that 6000 cu. ft. of gas are required per ton for burned lime, which on a basis of recent quotations for gas in the Oklahoma field indicates a fuel cost of less than $1 per ton of burned lime.

The American Cyanamid Co. added two rotary kilns to its plant at Niagara Falls, Ont., and brings the total number of kilns up to seven. This company uses powdered coal for fuel and has an annual capacity of 250,000 tons of burned lime, making this operation the largest single unit in the world. The lime is not sold but is used in connection with the company's nitrogen fixation process.

Significant Happenings

The Lime and Hydrate Plants, Inc., is expected to install a four Kuntz gas producer fired kiln addition to the lime plant that H. E. Millard recently purchased from W.



Yearly lime production since 1907

T. Bradley, Swatara, Penn. When completed, this will be an eight-kiln operation.

The Warner Co., Philadelphia, Penn., developed a special car for hauling hydrated lime in bulk from its McCoy plant to the "Trowlite" plant near Conshohocken, Penn.

The National Carbide Co. built a new shaft-kiln plant in Virginia in 1929. This plant was designed and erected by Victor J. Azbe, consulting engineer, and a frequent contributor to these columns.

The Palmyra Lime Co. at Clarksville, Tenn., is reported to have resumed operations after a lapse of five years. The Batesville White Lime Co. entered the crushed stone business with a new plant at Batesville, Ark., during this year. Crushed stone has developed to be the chief product of several southern lime companies.

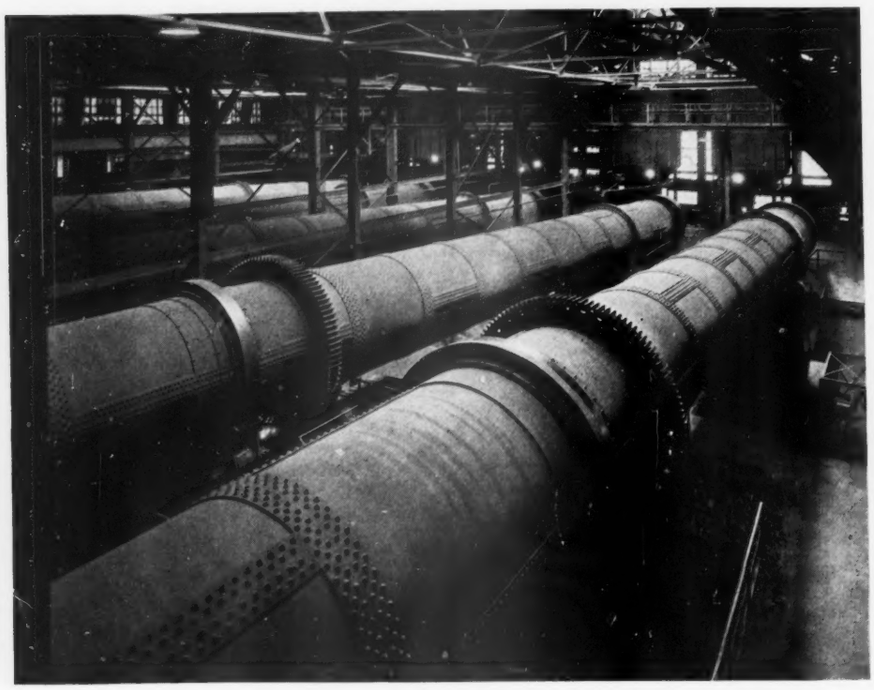
The Standard Lime Co., headed by Harry Burgess, took over the operation of the Calera Lime Works at Calera, Ala. The Southern Lime Co., Nashville, Tenn., went out of business when its properties were sold. This company's Burns plant is now operated by the Jesse Allen Lime Co. and the Palmyra plant by G. W. Dinsmore.

A new lime plant consisting of two kilns was reported to have been designed by Arnold and Weigel, Inc., for M. A. Wheeler at High Cliff, Tenn., and the Southland Lime Co., Nashville, Tenn., suspended operations at Arlington, Tenn.

The National Lime, Cement and By-Products Corp., Buffalo, N. Y., expects to start construction of a plant at Tuscumbia, Ala., during the early spring of 1930. Plans call for the production of 100 tons of lime per day, half of which will be hydrated.

The R. N. Horton Lime Co., Richlands, W. Va., is reported to have started a new operation early in 1929.

The Sheboygan Lime Co. started using Gardner-Denver paving breakers for breaking stone to kiln size and reports that the use of this type of breaker has reduced the number of men required considerably. The saving in man power easily offsets breakage of bits, it is said.



Kiln room of American Cyanamid Co.'s lime plant at Niagara Falls

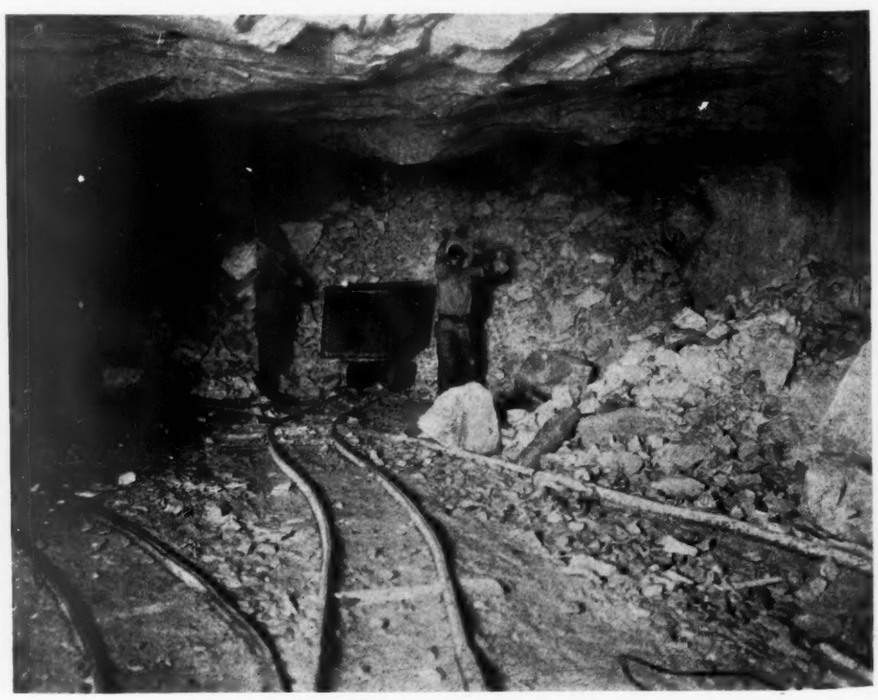
The Manistique Lime and Stone Co., Manistique, Mich., dismantled its old plant as the equipment is considered obsolete. This company was taken over late in 1928 by the Inland Lime and Stone Co., a subsidiary of the Inland Steel Corp. of Chicago, Ill., and during 1929 a new harbor and wharf facilities was constructed near Manistique to handle about 10,000,000 tons of limestone for lake shipment per year.

In the Ohio district, the Washington Building Lime Co., Woodville, Ohio, completed the installation of a rotary kiln for making finishing lime. The company operates 32 shaft kilns at present.

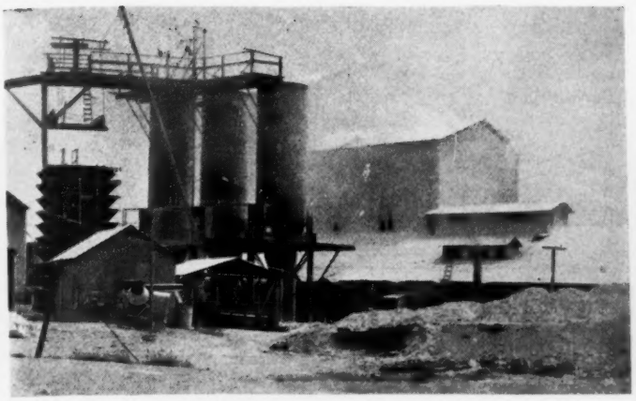
The France Stone Co., Toledo, Ohio, purchased the assets of the William L. Urschel Lime and Stone Co., which operated a lime plant and crushed stone plant at Gibsonburg, Ohio. The plant and quarry of the Ohio Blue Limestone Co., Marion, Ohio, was sold to the National Lime and Stone Co., Findlay, Ohio, which now operates nine plants in central Ohio. The Central Lime and Cement Co. and the Wisconsin Lime and Cement Co., distributors of Wisconsin lime, were merged with the Consumers Co. in the Chicago territory.

The Peerless White Lime Co., Ste. Genevieve, Mo., lost its warehouse by fire during the year and replaced this old wood structure with a fireproof one. The new building is more conveniently arranged for storage and will contain barrel-making equipment. The company recently purchased a 400-hp. 250-lb. pressure Heine water tube, boiler, which replaces some old boiler equipment. The new boiler equipment includes a Laclede chain-grate, forced-draft stoker and automatic coal handling equipment, and a water-softening plant.

A new plant, built by the Clearwater



Mining limestone at Sonora, Calif.



Producing dolomite lime at a western operation

Snowflake Lime, Ltd., plant, St. John, New Brunswick, Canada

Lime Products Co., to consist of two vertical kilns, was reported to have started at Orofino, Ida., capable of producing 25 tons of lime per day. The lime will be shipped for the most part to the cities on the Pacific coast. The Pueblo Lime Co., Pueblo, Colo., was reported to have doubled the capacity of its plant which now produces about 20 tons of lime per day. The Standard Lime plant at Gold Hill, Ore., planned on reopening its plant. Activity was also reported in the Medford, Ore., district, where the Standard Products, Inc., expected to build a lime plant.

Industrial Development in Canada

Production as a whole in Canada seems to have been fairly well balanced as compared to 1928, but individual producers reported a falling off in tonnages of from 5 to 20%, depending upon the grade and kind of lime quoted. Barrelled lime showed the greatest decrease. Prices apparently were unchanged. Conditions in 1930 are expected to be about the same as for the past year as regards tonnage and many expect a slight increase in price. One producer reported a 70% increase in his production and sale with the comments, "Our increase comes chiefly on account of plant expansion, also good year for construction in Canada, while our progressive policy has left competitors far behind."

The Restigouche Co., Ltd., was succeeded by Snowflake Lime, Ltd., January 1, 1929, the new company continuing extensions and improvements started the previous year by the older company. A Schulthess No. 4 hydrate plant was installed in 1928, and in 1929 lump lime storage bins, automatic feeders, dust collecting systems, etc., were installed. The company reported that it had been in operation 15 hours per day since March 1. One kiln was repaired and enlarged and placed in operation this year, this kiln having been idle for 35 years, and four kilns have been operated regularly until this winter, when production was supplied from three kilns.

The Canada Gypsum and Alabastine, Ltd., added to its lime holdings by purchase of the Beachville Lime and Stone Co., the Christie Henderson Co., the D. Robertson Lime Co., the Toronto Lime Co. and the Wellington Lime Co., all in the province of Ontario, and the Standard Lime Co., Quebec.

Special Limes for Masonry

There appears to have been considerable activity in manufacture of special mortar limes and cements as evidenced by the number reported as having started production among who might be mentioned the Midwest Crushed Stone Co., Greencastle, Ind.; the Marble Cliff Quarries Co., Columbus, Ohio; Century Cement Co., Rosendale, N. Y.; the Western Lime and Cement Co., in Wisconsin, and others.

Incorporations

The following list of new incorporations probably is not complete, but includes practically all of the charters of any consequence during the past year.

For comparison, the totals for 1927 and 1928 were as follows:

	No. of Incorporations	Amount Capital Par Value
1927	22	$1,010,000
1928	19	†2,225,000
1929	19	*1,182,000

† Three companies listing stock of no par value; seven with stock of no par value.

LIME COMPANIES INCORPORATED DURING 1929

State	Amount of Capitalization Par Value
California	*
Delaware	*
Delaware	*
Delaware	$ 50,000
Idaho	500,000
Indiana	*
Indiana	*
Indiana	7,000
Illinois	1,300,000
Ohio	40,000
North Carolina	*
Oregon	60,000
Pennsylvania	10,000
Tennessee	50,000
Virginia	15,000
Virginia	100,000
Tennessee	50,000
New York	*
Total	$1,182,000

* Listed as of no par value.

Comments from Producers

"The lime industry must necessarily be reduced by consolidations into fewer and larger units before any systematic plan of restricted production can successfully function. . . ."

* * *

"It looks to me like we must find new markets by co-operative trade association effort and defend the ones we now have. . . ."

* * *

"Matters would be helped if the producer who is using someone else's money would quit price-cutting. . . . The stockholders are entitled to dividends as well as the individual producers. . . . Rules no doubt can be made which will benefit the industry if the mighty would see fit to adhere to them. . . ."

* * *

". . . Subscribing to the federal trade practices, whether connected to the National organization or not, comes nearest to common sense and co-operation than we can conceive of. . . . "

* * *

" . . . Am unable to give any plan that would decrease production. . . . What we need is more effort to increase consumption. It is well within possibility that there should be no over-production if lime were used where it should be. . . ."

* * *

". . . We do not believe there is overproduction, hence no necessity for restriction. . . The producer should strive to meet the market demands for quality, and give his best services and reduce cost by maximum production. . . . The only way to restrict production is to restrict alike to the same percentage of rated capacity. . . ."

* * *

"The state or government to whom the natural resources (limestone) rightfully belongs should regulate output to avoid waste. Restrictions should be regulated by zones and the initial investment in lime plants should be regulated by state commissions on the same basis. . . . There certainly should

be laws to regulate over-production in any one locality which interferes with the marketing of the commodity made in a zone within reasonable distance of point of use. . . . Refusal of permission to build new plants where those already in existence in that zone show capacity which results in overproduction. . . . If, when this lime company applied for a charter to manufacture lime, its promoters had been told by reliable authorities that there was already an overproduction and were refused incorporation papers, we would have been most *grateful.*"

* * *

"Voluntary co-operation of producers will accomplish wonders under the proper leadership. While much good work has been done, the field is barely tapped. I have in mind a specific instance in the lime industry where two large cities are separated by about 500 miles. Each district has its producers of lime. Each producer is shipping into both cities and standing the burden of a high freight rate to keep his plant going as near full capacity as possible. This 'cross-haul tax' carried by these producers will amount to a tremendous sum annually and should be reduced to the minimum. If each producer could ship his product into home territory without outside interference the consumer would pay no more and the producer would receive a higher net price for his product.

"Now, let's assume that producer A ships into producer B's territory 10,000 tons annually and producer B ships into producer A's district approximately the same amount, it is obvious that they could sit down at a table and with a little horse sense and sincere co-operation do a mighty good day's work. Perhaps decide then and there the difference between a deficit and a profit at the end of the year.

"Every district is a problem in itself, and somewhere in the industry there ought to be a *MOSES* big enough to organize the situation and put over such a program. Whether we like it or not, the fact remains that the rock products industry as a whole is miles behind some other lines in effective national co-operation for more efficient and more profitable operation.

"Whatever plan is used, beneath it must be established firmly the basic principle of giving every man the free moral right to run his business as he believes best. Plans, agreements, co-operation, etc., must be placed on an equitable basis and made sufficiently attractive to appeal to the average manufacturer or producer. If in the general leveling off of tonnage and prices the high cost plant is crowded out, that can be no fault of the industry as a whole; and it certainly is poor economics to operate a high-cost plant for any reason whatever when a low-cost plant is available for the same market territory. But the operator of the high cost plant alone is qualified to judge when he is crowded out and should have opportunity to fight out his high-cost problem under fair ethical competitive conditions. Summed up briefly—members of the rock products industry should sell themselves the idea of a high standard of business ethics as a basis upon which they are willing to work. Have that standard formally accepted by the Federal Trade Commission, stick to their program and the high-cost plant, the pirate producer, the hangers-on, etc., will automatically gravitate to their proper position in their relation to the industry as a whole. This is an age when the high standard of business methods are respected and no producer can well afford to violate his group standard."

Association Activities

The National Lime Association was reorganied in June, 1929, with a salaried all-time president—Norman G. Hough. Since then a large part of President Hough's time has been devoted to organizing, and attempting to organie, the industry into district groups, which with the help and prestige of the National Association can solve some of their most pressing problems. District statistical associations, or bureaus, have been organized and are functioning in Chicago, for the central group, and in Boston, for the New England group. The prospects of the National Lime Association and of the industry were never better than at the present moment, if lime manufacturers will have sufficient confidence in one another to support it.

Talc and Soapstone in 1929

THE TALC AND SOAPSTONE INDUSTRY is one that showed a decided increase in production during the past year, contrasting quite strongly with the other rock products industries. Producers all reported gains of from 5 to 20% in tonnage, and the reported increases were confined to the larger and better equipped plants. Prices during 1928 showed some gains, depending on the grade of material, but there was a drop in prices during 1929. There were 20 companies operating during 1928. One reported starting a new plant in 1929 and several companies reported increasing their capacities. A new plant now being built is owned by the Vermont Mineral Products, Inc., at Chester, Vt., and is of comparatively small capacity.

Last year, in our annual review, we mentioned that the talc and soapstone producers should form a national association to develop new uses for talc and soapstone. The replies received to our questionnaire on the measures that should be taken to correct conditions within the industry contained expressions of the need of such co-operative work; and undoubtedly if some of the producers made a serious effort to form such an association much good could be accomplished. Apparently if the talc and soapstone industry is to show a healthy growth *new carload volume* uses for the material will have to be developed by association funds. Talc is now used in a hundred or more ways but less than a dozen industries use it in car lots.

Among the companies which increased their plants' output by installing additional equipment were the Blue Ridge Talc Co., Henry, Va., which installed a Raymond pulverizer and increased its bin and crude storage facilities, increasing the capacity by about 20%. The American Soapstone Finish Co. opened up two talc quarries at Chester Depot, Vt.

The following new incorporations were recorded to mine and process talc and soapstone:

Dixie Soapstone Products Corp., Arlington, Va.

Nantahala Co., Hewitts, N. C.

G. J. Bentley and James Duncan, Bagby, Calif.

National Soapstone Co., West Jefferson, N. C.

Moorwood Products, Calgary, Alberta, Canada.

MacMyrl Talc Mining and Minnig Co., Upper Skagit Valley, Wash.

Ceramic Society Program

A PRELIMINARY program of events scheduled for the annual meeting of the American Ceramic Society and American Refractories Institute to be held at Toronto, February 16 to 21, 1930, has been released.

TALC AND SOAPSTONE SOLD BY PRODUCERS IN THE UNITED STATES, 1923-1928

	Crude			Sawed and manufactured						Ground			Total		
				Talc			Soapstone								
Year	Short tons	Value	Value per ton	Short tons	Value	Value per ton	Short tons	Value	Value per ton	Short tons	Value	Value per ton	Stort tons	Value	Value per ton
1923.....	5,706	$50,125	$8.78	628	$114,772	$168.00	22,857	$932,098	$40.75	167,447	$1,915,258	$11.50	196,692	$3,012,253	$15.30
1924.....	5,710	22,247	3.90	846	109,405	129.00	25,630	1,288,885	50.30	171,635	2,095,019	11.75	203,821	3,515,556	19.00
1925.....	5,684	24,533	4.33	895	107,691	121.00	.....	.....	.....	175,677	1,879,569	10.70	182,256	2,011,793	11.05
1926.....	5,988	26,723	4.47	1,528	130,253	87.00	.....	.....	.....	174,052	1,954,018	11.20	181,568	2,110,994	11.50
1927.....	5,706	25,365	4.43	1,494	111,650	75.00	.....	.....	.....	185,116	2,097,709	11.30	192,316	2,234,724	11.60
1928.....	6,360	48,031	7.55	936	70,394	75.10	.....	.....	.....	195,680	2,419,569	12.40	202,976	2,537,994	12.50

Silica Sand in 1929

OWING to major consolidations in the glass-sand producing districts in the Eastern states and Ohio and Illinois recently, there has been a gradual strengthening of prices in the silica industry, although the increases in price on glass sand were slight and in some locations there was no price movement during the past year. In the Pennsylvania districts, quotations as of December, 1929, were 25 cents per ton higher than at the same period in 1928. In the Virginia glass sand producing areas prices increased from 50 cents to $1 per ton, December quotations being $2.50 to $3 per ton. All the other sand producing districts showed sationary prices during 1929. Prices on core and foundry sand for 1929 were substantially the same as for 1928 except in the Ottawa, Ill., district, where sharp drops in prices were reported.

The Millville district of New Jersey reports a very busy year, with a large tonnage of silica sand being moved to the steel mills and iron foundries. Prices advanced about 50 cents per ton during the year. The tonnage of silica sand showed slight gains for 1929 over 1928. California especially showed an increase in production variously estimated at from 30 to 50%.

There were three new incorporations in silica sand industry noted in ROCK PRODUCTS during the year, with a total capitalization of $3,025,000; one company went into the hands of the receivers and one company was dissolved.

Mergers of Importance

The new Industrial Silica Corp., incorporated during the year, was a consolidation of 14 former independent companies in Ohio and Pennsylvania. The new company will have a capacity of 600,000 tons per year, making it one of the largest producers of silica sand in the United States. The main offices of the company will be in Youngstown, Ohio. Companies included in the merger are Portage Silica Sand Co., Youngstown; Geauga Silica Sand Co., Cleveland; Dundee plant of the Ayres Mineral Co., Zanesville; Oliver Silica Sand Co., Franklin Industrial Sand Co., Coxey Silica Sand Co., Massillon Sand and Stone Co., Corvin, Albright Sand Co., Newman Silica Sand Co., and the sand plant of the Everhard Co., all of Massillon; the Beach City Silica Sand Co., Beach City; Leesburg Silica Sand Co., Leesburg, Penn.; Dick Sand Co. and Venango Sand Co., Franklin, Penn. The merger resulted in abandonment of several out-of-date high-cost operations.

Another merger was that of the Universal Silicate Co. of Hollywood, and Abramson-Bodie Lime Products Corp. of Lindsey, Calif. The new company will be known as the Universal Silicated Stucco Lime Products Corp. It plans considerable improvement at its plant at Lindsey.

New Plants Under Construction

At Tatesville, Penn., the Pittsburgh Silica Sand Co. is now building a new glass sand plant of 500-ton per day capacity. The equipment includes a 36x42-in. primary crusher; two 12x20-in. secondary crushers with apron feeders; two 9-ft. chaser mills; sixteen 22-in. washers, a steam dryer and two Hum-mer screens, in addition to the necessary bucket elevators and belt conveyors. The 150-hp. boiler being installed will have sufficient capacity to take care of a second dryer to be put in later. The plant will have a 100x45-ft. sand drainage building equipped with an overhead electric crane. Shipment will be made over the Huntingdon and Broad Top railroad. Lewistown Foundry and Machine Co. designed the plant and Rust Engineering Co. are erecting the foundations and buildings.

The Berkeley Glass Sand Co. at Berkeley Springs installed four complete grinding units furnished by the Lewistown Foundry and Machine Co. for the new plant now under construction.

New plants built in the Millville, N. J., district were: One by the George Pettinos organization of Philadelphia, at Millville; and the Eureka Flint and Spar Co., of Trenton, N. J., erected a silica pulverizing plant at Columbia Way. The Columbia Silica Co., Akron, Ohio, was reported to have rebuilt its plant which was destroyed by fire March 2. Silica Products Co., Guion, Ark., installed new boilers and other equipment during the year.

Corona Silica, Inc., acquired a large deposit of amorphous silica at Rogers City, Ark., and built a large processing plant. An unusual feature is the mining operations carried on to recover the silica from the beds which are 85 ft. thick in places. Motor trucks are used to bring the crude silica to the washing plant. The plant is modern, electrically operated and has pebble mills for grinding, a Louisville rotary dryer, Hum-mer screens and Gayco air separators. The product is marketed as "Opalite."

Tariff Situation

Early in the year the Commissioner of Customs of the Treasury Department ruled that Belgian sands and other similar glass sands could be admitted free, predicating its decisions on protest of the Belgian sand importers that Belgian sand was known as sand and not silica. A reclassification of silica sand was asked for at the hearings before the committee on Ways and Means, House of Representatives, during the year, in connection with the proposed new tariff bill.

The reclassification asked for would take silica sand suitable for glass making off the free list and make it dutiable at $4 per ton. The request was made before the Senate finance committee.

A silica sand operation in central Pennsylvania, showing the type of plant which has succeeded numerous small ones formerly operated by independent producers

Slag in 1929

PRODUCTION of slag during 1929 apparently showed a slight increase due to the record-breaking activity of the steel industry, but shipments were about the same as for 1928. In the Buffalo district sales dropped about 10% with production 5% greater. The shipments in the Duquesne and Erie districts were a trifle larger than for last year.

Judging from the number of new plants that are being built and prospective competitive conditions, there may be a weakening in the price of slag during 1930, with but slight increase in sales expected. Where price drops were noted in 1929, the recession was gradual throughout the year.

The American Materials Corp., owned jointly by the France Slag Co. and the American Aggregates Corp., built a new slag screening and crushing plant at Hamilton, Ohio. This is the first slag venture of the American Aggregates Corp., which operates the plant. The plant was designed and built by the engineering department of the American Aggregates Corp., and uses a No. 6 Gates primary crusher and a 6-in. Superior McCully fine reduction crusher, with the balance of the equipment made by the Greenville Manufacturing Works. The plant has a capacity of 600 to 750 tons per day. Slag is secured from the steel plant of the Hamilton Coke and Iron Co., near Hamilton. Molten metal from this steel plant is hauled to rolling mills at Middletown, Ohio, a distance of about 12 miles, in specially constructed ladle type cars holding 100 tons of metal each. The cars are so well insulated that steel can be kept molten for several days. The plant is located on the rails of the Baltimore and Ohio and Pennsylvania railways and also has facilities for truck shipments.

The Buffalo Slag Co. is breaking ground for a new plant to replace its old wooden one known as No. 2 in the Lackawanna district. This district ships about 600,000 tons of slag annually. The new plant will be of steel and reinforced-concrete construction throughout. In the Birmingham, Ala., district there were two new plants built during 1929, according to reports, one by the Birmingham Slag Co., at Fairfield, having a capacity of 2000 tons of slag per day, and one at the plant of the Sloss-Sheffield Steel and Iron Co., Birmingham, Ala.

The National Slag Association, with headquarters in the Leader Building, Cleveland, Ohio, was quite active and continued to issue throughout the year a series of pamphlets on the various uses and properties of slag. Abstracts of these symposiums were published in ROCK PRODUCTS during the past year as follows: No. 8, "Use of Slag in Bituminous Construction," May 30; No. 9, "Use of Slag for Railway Ballast," May 25; No. 10, "Is There Any Corrosive Quality in Slag," July 6; No. 12, "Slag in General," September 28; No. 13, "Water Resisting Concrete of Slag Aggregate," September 28; No. 14, "Physical Characteristics of Slag Aggregate," November 23; No. 15, "Rolled Slag and Traffic Bound Roads," August 31; No. 16, "Workability of Slag," June 8; No. 17, "Resistance of Slag Concrete to Certain Destructive Agencies," June 22; No. 18, "Strength of Slag Concrete," August 8.

Steel plant of the Hamilton Coke and Iron Co., Hamilton, Ohio. The slag plant of the American Materials Corp. is in the center foreground

Survey of Limestone and Phosphate Situation in the Midwest States

By J. R. Bent

Manager of the Limestone and Phosphate Department, Illinois Agricultural Association; Secretary of the National Agstone Association

IN REVIEWING the agricultural limestone situation in the midwest or grain states, it is at once clearly apparent that the year 1929 has marked another substantial step forward. This is true as regards character of material and method of use and it is especially true as regards total volume used and the number of users. For several years past each successive year has realized increasing attention given by the quarry industry to agricultural limestone as a specialized product requiring and deserving special attention. In like manner each succeeding year has seen the use of agricultural limestone become more and more a fundamental factor in successful farm management.

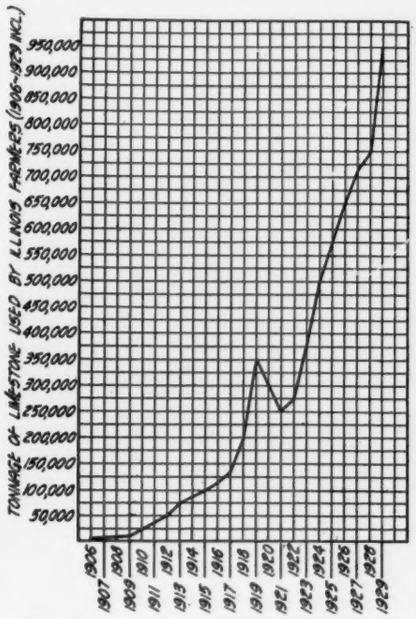
In a much more pronounced way, than is true of crushed stone generally, agricultural limestone has a demand or using season which is distinctly short and concentrated. Perhaps it would be more accurate to say there are two seasons. Normally the period covered by August, September and October develops at least 75% of the year's demand, and if the spring is an open and favorable one, the month of March stands out as a minor peak. Certain months, particularly May, June and early July, normally show little or no demand. This high concentration is due to the normal cycle of farm operation. Valuable as limestone may be to the farmer, it is out of the question for him to attempt to use it in either a planting, cultivating or harvesting period.

The concentrated seasonal demand not only imposes difficulties on the producer and shipper of agricultural limestone but it also carries with it the danger that even a short period of unfavorable weather, if it comes at the critical time, can very greatly and adversely affect the year's tonnage as a whole. The years 1926 and 1927 were very unfortunate in this respect and resulted in a serious break (in some sections even a reversal) in the otherwise rapidly upsweeping tonnage curve. Reference to the chart which accompanies this review and which covers the tonnage consumed in Illinois clearly illustrates the foregoing statement. The year 1929 proved to be very favorable so far as weather was concerned. This, coupled with the fact that the farmer's financial status has improved noticeably in most sections, and also with the fact that the agricultural limestone project has been given major attention by many farm bureaus and county agricultural agents, has accounted for a very gratifying growth in tonnage during the year just closed.

Producers Should Pay More Attention to Plant Storage

At most of the commercial quarries the production of agricultural limestone must be co-ordinated with the production of other sizes of stone throughout the entire nine or ten months of normal operation. Normally a large portion of the agricultural stone is the result of direct screen separation; often 4-mesh minus by-product screenings. The long season of production, compared with the much shorter season of shipments, results in the necessity for at least temporary storage at the producing plants. Frequently temporary accumulations in open ground storage at individual plants have amounted to more than 50,000 tons. Such open storage, with means for recovery during the shipping season, constitutes a major problem at many plants.

With a commodity of the bulk and low unit value characteristic of limestone, a few cents per ton more or less in the cost of rehandling becomes an important factor. Also the percentage of the material in open storage which can be recovered and utilized satisfactorily has a very direct and material bearing upon the average cost per ton; and lastly the quality of the material which has been through storage and reclamation, as compared with the current product, has a very great bearing upon its marketability. For all of these reasons the writer has felt



Yearly tonnage of agstone used in Illinois by farmers

that the quarry operators can well afford to give more constructive thought to the storage problem.

Attempts have been made to provide storage at destination points. Here and there storing of agricultural limestone as a merchandising proposition for subsequent less-than-carload sales can be accomplished with satisfactory results, but as a rule the large volume desired by the individual farmer and the relative saving which he can effect by hauling direct from the car to his farm cause the farmer to order in carload lots and only during the time of the year when he is able and willing to spread the material on his fields.

Greatly Increased Demand in 1929

The survey, state by state, which is shown at the end of this article would indicate how greatly the demand increased during 1929. As against this crushed stone production, of which agricultural limestone is only a related part, suffered a material falling off during 1929. The building of cement highways and demand for concrete aggregates in the construction of city buildings seem to have slowed up very noticeably in the Midwest during the year. In the Chicago area some producers have expressed the view that production of crushed stone, as a whole, was from 20% to 30% less than the year previous. The increased demand and decreased current production of agricultural stone has resulted in the cleaning up of many storage piles, some of which were of two or more years' standing. Practically all of the producers in the St. Louis territory sold all of their reserve and current production and some of them resorted to the use of auxiliary reduction equipment, such as pulverizers, working on some of the surplus larger sizes, to increase their supply. In one or two cases this was also true in the Chicago district and in other cases the reserve storage piles were much smaller at the close of this year than they have been for many years past.

Better Preparation

Many producers have been making real progress in the matter of cleaner screenings; first, in the elimination of impurities by the rejection of primary screenings (the fine portion coming from the first screening operation, following the first or primary crushing); second, in the adoption of finer mesh screens cutting down the maximum size of by-product screenings. It is apparent that these improvements in quality must re-

sult in the lessening of the normal by-product supply and has helped to lower the ratio of production to consumption. Some districts have seen much more progress in these matters of quality than has been true in other districts. In like manner some quarries have made more progress than other quarries in the same district.

The states east of Illinois have for the most part been on a basis of finer screen specifications than has been accepted in Illinois and states west. Even in the older states the tendency has been for the coarser material to give way to somewhat finer. However, it is doubtful if the very finely milled and expensive material is holding its own. In Illinois the producers in the southern section, particularly those around East St. Louis, have made more progress in the matter of fineness of screening than has been evident with the producers in the northern part of the state. This last statement should be taken as a general statement for it does not apply in all individual cases.

Some crushing and cleaning plants are much more flexible in their basic design—more easily adapted to the need for rejection of the finer sizes, if and when weather conditions make such a practice desirable. Quarries which are operating in a deposit with relatively heavy overburden, with irregular top; with open fissures (so-called mud seams), or with inter-bedded shale seams, cannot produce a clean fine size, such as agricultural stone, in any other way than by eliminating the first or "primary" fines. This is particularly true in wet weather. Unfortunately with some quarries it is very difficult to arrange their "flow sheets" so as to provide for such elimination. The result is that the product suffers in quality in comparison with that of competitors.

Again the Question of Fineness

The necessity for resorting to direct pulverization, which the writer has already touched upon, has aided in focusing attention upon the matter of specifications, for in operating a pulverizer the question immediately arises, "how fine should the product be to give greatest value per dollar of production cost?" Fortunately much more study is being given by competent authorities to the entire subject of basic specifications, and it is hoped that in the near future some step may be possible in the way of a standard score card which, even if found to be imperfect in detail, will at least set up some method of evaluation in comparing the production of one plant or district with that of another. Some of the interesting factors in this connection are the relative value chemically of the two main types of stone, "dolomitic" and "high calcium," and the relative solubility or responsiveness in the soil of the different screen segregates. The writer has been interested in an endeavor to bring about general adoption of a uniform basis for determining the percentage of these segregates in a product, and is convinced that the following Tyler series of screens is best adapted to this purpose:

4-mesh; 8-mesh; 14-mesh; 28-mesh; 48-mesh; 100-mesh.

During the earlier days in the use of agricultural limestone in Illinois, little attention was paid to either the chemical or the physical character of the material used. In general, by-product screenings were considered satisfactory, even though they varied considerably as to maximum size; also no distinction was drawn between dolomitic and high calcium stones, for the natural economic source of supply controlled and both types got results. In the southern and south central portions of the state, however, where limestone is used the most heavily, the two types have come more or less into competition, resulting in competitive claims and somewhat conflicting viewpoints. Realizing that such a situation is unfortunate and tends to confuse the farmer and thus retard the development of the use of limestone, the Illinois Agricultural Association asked the scientific specialists of the University of Illinois to prepare a statement for use as a general guide in such cases. The following is the statement prepared by Dr. E. E. DeTurk of that institution representing the opinion of its staff, based upon their research and experimentation:

Value of Different Limestones

"1. *Neutralizing Value.* This is a matter of major importance, since the neutralization of soil acidity is the main object of using limestone. The neutralizing value is readily determined by a simple chemical test and may be expressed in definite, easily understood numerical terms as 'calcium carbonate equivalent,' sometimes abbreviated, 'C.C.E.' High calcium limestones can carry as high as 100% C.C.E. Dolomite limestones can go as high as 108.7% C.C.E. However, two stones showing the same C.C.E. have equal neutralizing value, regardless of their relative content for calcium and magnesium carbonate. Dolomite is calcium-magnesium carbonate, $CaMg(CO_3)_2$. Dolomitic limestones are mixtures of dolomite and calcium carbonate, $CaCO_3$, in varying proportions.

"2. *Speed of Reaction.* The relative speed of reaction in a liquid solvent, such as an acid in aqueous solution is not a measure of the speed of such reaction in a solid medium such as the soil. In the former case, the inherent rate of solution is not checked by accumulation of dissolved products, while in the latter case, the soil in immediate contact with a given particle is quickly neutralized and the particle is then surrounded by a non-acid environment, hence the solution rate is greatly retarded. Thus, in acetic acid, with stirring, high calcium limestone dissolves about twice as fast as dolomitic stone of the same size particles; in the soil, the difference in rate of solution is negligible except in sizes approximately 0.1 in. and larger. Because of these conditions, the relative rate of solution of different sizes in the soil is determined to a greater extent by the number of particles than by the total surface of the limestone. Accurately controlled experiments, as to fineness and thorough distribution have shown both with respect to clover growth and chemical reaction in neutralizing soil acidity, that:

(*a*) When finely ground (through 100-mesh), dolomitic and high calcium types of stone are essentially equal, dolomitic having shown a slight advantage in clover growth in our experiments.

(*b*) When 10-mesh or coarser, the dolomitic type is distinctly less effective than the high calcium.

(*c*) With screenings carrying the entire range of sizes, the two types are approximately equal, except with heavy applications in which case the high-calcium type shows a slight gain over dolomite.

These facts suggest the undesirability of very high proportions of very coarse material in any stone, but particularly so in the case of dolomitic limestones.

(*d*) Heavy applications of coarse limestone will producer closer growth even before much of the soil has been neutralized, whenever the small neutral centers about the particles, are sufficiently numerous to be accessible to crop roots; the amounts required to bring about these conditions, however, are entirely impracticable. For example, at least twice as much stone of 8-mesh size will be required as of average screenings, while with 4-mesh stone, approximately six times as much are required as with 8-mesh.

Durability in the Soil

"3. *Durability in the Soil.* True durability dates from the time limestone decomposes in the soil and begins rendering service. Soil acidity, like the acidity of all acids, is due to hydrogen ions; however, in the acid soil the hydrogen ions are attached to negative colloid particles instead of to negative SO_4 ions as in sulphuric acid (H_2SO_4) for example. Colloids are the smaller sizes of clay particles. When an acid soil is limed, the calcium and magnesium of the dissolved limestone displace the hydrogen ions from the soil colloids and form a non-acid colloid, more or less saturated with these bases. These colloid particles with their absorbed bases are too large to be moved by leaching; that is, they are not in solution, and the beneficial effect of the liming is permanent except as the base-saturated colloids gradually decompose again in the soil water. This explains the durability of over 20 years of finely powdered hydrated lime added in 1902 in a very single application on the Dubois (Illinois) experiment field. Calcium and magnesium limestones are equal in durability, since the calcium "colloidate" and magnesium "colloidate" lose their base in the soil under approximately identical conditions.

"In addition to the durability of decomposed limestone acting in the soil, the coarser fraction of screenings remains in the soil gradually becoming useful as it dissolves.

Considering this type of "durability" or reserve supply, coarse dolomitic limestone will persist longer than high-calcium limestone of equal size because of its slower rate of solution. This reserve, however, is of comparatively little value, compared with real durability.

"4. *Plant Food Value.* Calcium and magnesium are both essential plant food elements. No cases are known in Illinois of magnesium deficiency in soils for plant growth. Deficiency in available calcium may occur in the case of a few crops having high calcium requirements on very acid soils.

"The amount of limestone required for correcting acidity is so much greater than that required for adequate calcium supply for crops that plant food value ceases to be a significant question. Calcium needs are always met by limestone additions which are sufficient to correct acid soils, regardless of whether the dolomitic or high calcium type is used.

"From the above considerations, it may be stated that the agricultural value of limestone depends upon its effectiveness in correcting soil acidity, and that this depends primarily upon two factors, neutralizing value, or 'C.C.E.,' and fineness."

At various state experiment stations research is well under way relative to the part which limestone plays in the problem of soil fertility, and particularly, the effect which it may have, for good or for ill, upon the availability of other necessary plant food elements. Quarry operators who are interested in making agricultural limestone an important factor in their production and sales programs should be interested in following these efforts in an open-minded and co-operative way.

Farmers Using Limestone Intelligently

It is interesting to note, that whereas in former years relatively few farmers used relatively large amounts of limestone, today many more farmers are using this soil conditioner in limited or measured amounts adapted to an intelligent knowledge of the needs of each acre to which it is applied. The old unintelligent arbitrary rule of so many tons per acre once every so many years is passing into the discard. The county agricultural agent and the farm bureau organizations are finding a new demand placed upon their services as a result. The old missionary work which consisted of teaching the farmer the importance of using limestone has given place to the new project of teaching him how to use it to the best advantage. With improvement in the product itself, particularly as to fineness, and with some tendency for the price to advance as a result thereof, and especially with the recognition of the importance of adjusting the application to the needs of the soil, a need is being felt for a corresponding improvement in the design of distributing machinery.

Two or three years ago a serious attempt was made to stimulate shipments of agricultural limestone in the "off" season by establishing a differential in price. While this had some little effect it did not accomplish as much as was hoped and in most districts the practice is disappearing. It is impossible to make a sufficient difference in price to compensate the farmer for the disadvantage of off-season handling.

Tendency to Quote Delivered Price

The tendency has been very markedly toward an adoption by nearly all quarry operators of the delivered price basis of selling. A few years ago the operators were divided about fifty-fifty between a quarry price and a delivered price. In coming to the delivered price an attempt has been made to partially, though not entirely, equalize freight difference in local territory. If this is to be accomplished at all perhaps the logical thing is to go the rest of the way and establish a delivered price, regardless of source or the handling railroad, which would be uniform throughout a well defined zone of several counties. This might be more easily accomplished in some states than in others. It would have its advantage and disadvantages; but some of its disadvantages could be eliminated through individual producers refusing to quote at all in any territory which could not be reached with a reasonable freight charge.

Various methods of selling have been adopted. Some of the older and well-known quarry companies receive many orders by mail direct from the individual farmer. Some of the larger producers maintain selling agents on the road. Most of the producers have more or less business through so-called dealers which usually are local grain elevators, coal and lumber yards, etc. Most of the business done through dealers, however, is in the nature of brokerage business on carloads taken by individual customers. The largest single channel through which agricultural limestone has moved, particularly in Illinois, has been the local county farm bureaus. Producers recognizing this fact have been willing, and have found it advantageous, to recognize and encourage the farm bureaus through co-operative agreements with the overhead state organization.

Future of Agricultural Limestone

Facing the year 1930, and the future generally, the following facts seem to stand out.

(1) Demand is overtaking by-product supply.

(2) Direct production is becoming more and more necessary.

(3) Quality, relative to price, will receive more intelligent consideration by both producer and buyer.

Situation as to Ground Phosphate

The year 1929 has seen an increase in the use of ground rock phosphate for soil fertilization as compared with any previous year since 1920. As heretofore much the larger part of the output of this commodity has been used in Illinois, but other nearby states are now developing a more active interest, and the producing companies in central Tennessee are devoting more attention to introductory work in these other states.

The product itself has undergone a considerable refinement in the last two or three years, particularly as to fineness of grinding. The leading companies are turning out a product which will run 99% or more through a 100-mesh sieve (equivalent to 10,000 openings per sq. in.). In view of the fact that the present product is so nearly 100% through a 100-mesh screen, there is some probability that the basis of measuring the degree of fineness will be changed so as to use a 200-mesh sieve (40,000 openings per sq. in.). The degree of fineness of grinding will not be directly affected by this change, if it takes place, but simply the method of measuring.

With the much more finely ground product, and the advancing knowledge as to the best method of using it (which now calls for thorough incorporation in the tillable soil, rather than the old practice of turning the commodity under, in contact with some organic matter, such as manure or legume crop) attention has been focused upon the types of machinery used for distributing in the fields. What has already been said herein as to limestone spreaders is also (and much more) true of phosphate spreaders. It is to be hoped that machinery manufacturers will be able to bring about great improvement in their design, in the near future, for in the opinion of many this factor is the weakest one in the many factors involved in production and use.

Reports from Midwest States

As in previous years, the writer has sought and has received very helpful and interesting facts from certain specialists and authorities in some of the midwest states, other than Illinois, and wishes to make grateful acknowledgement accordingly. A summary covering each of these states follows:

Michigan—Professor G. M. Grantham, research associate in soils, Michigan State College, states that the amount of agricultural limestone used in Michigan during 1929 is probably not much different from that used in 1928. A severe drought during the middle and late summer in the limestone-using section probably prevented a greater tonnage, which might otherwise have developed. There has been a tendency for the character of the material to be a little finer ground this year. The price has been slightly higher than in 1928. Some hydrated lime has been used, the price of which was less in 1929 than in 1928. Professor Grantham says the prospects for 1930 are bright. Portable, local crushers are not a factor in Michigan.

Ohio—From Professor Robert M. Sal-

ter, of the Ohio State Agricultural College, comes the report that tonnage figures for 1929 are not yet compiled, but it is his impression, after talking with a number of producers, that the figures for 1929 will slightly exceed those of 1928, possibly by 10% or 15% —(in 1928 some 210,633 tons of all liming material were used, to which agricultural limestone alone contributed about 180,000 tons). The character of the material has undergone no marked change, although the trend toward increased fineness seems to continue, and there has been more hydrated lime used during the year just ended because of a material drop in its price. The outlook for 1930 appears favorable. Farmers are taking renewed interest in matters of production and their purchasing power has been gradually increasing. Professor Salter thinks that the average cost of ground limestone, including freight, will be $3.35 per ton and the average of all liming material, if hydrated lime is included, would be about $3.40.

Indiana—In a letter from Professor K. E. Beeson, associate in agronomy, Purdue University, he expresses the following opinions: There probably has been an increase of 50% in the amount of limestone used in 1929 as compared with 1928. This is of necessity an estimate inasmuch as definite figures are not, as yet, collected. The tendency is toward finer material, particularly in the product of producers formerly selling ¼-in. minus screenings. These have substiuted a ⅜-in. screen for the former ¼-in. Professor Beeson thinks that the amount of limestone will certainly not decrease although the financial condition of the farmer and the weather are important factors in determining the amount used year by year. Professor Beeson says that in 1928 there were 110 local pulverizers operating in Indiana, some of which were producing road material, but many of which were contributing to the supply of agricultural limestone. Much of the commercial product is screenings resulting from the production of road-building material.

One of the leading limestone producers in Indiana gave it as his opinion that the total agricultural limestone consumption in Indiana for 1929 will be about 225,000 tons.

Kentucky—Professor S. C. Jones, field agent in soils, Kentucky Agricultural College, says that tonnage figures for 1929 have not been completed, but the data at hand so far shows an increase of from 5% to 10% over 1928. The total of all liming materials in 1928 was 250,000 tons, of which 225,000 tons was ground limestone. Portable crushers play an important part in the Kentucky supply (during the previous year 207 such machines were at work in 55 counties). These machines probably have produced more than one-half of the agricultural limestone used on Kentucky farms. The price charged by the operators of these crushers will average about $1.50 per ton where the rock is quarried by the farmer or about $2.50 for quarrying and crushing complete. The balance of the state supply consists of by-product screenings from the commercial plants. The price on this latter material ranges from $1.25 to $2.50 per ton delivered by rail. Professor Jones thinks that 1930 should show a further increase in total tonnage. He feels that more would have been used in 1929 if the commercial plants had not failed in shipments during the rush season.

Wisconsin — E. Truog, professor of soils, University of Wisconsin, advises that definite figures are very difficult to get together. It is his impression, however, that there has been a slight increase in 1929 as compared with 1928. The year just ended will probably show around 200,000 tons total used. The average price is about $3.00 per ton delivered. Local grinding outfits are in quite general use but are neither on the increase nor decrease. He thinks that 1930 should show some slight increase in total consumption.

Rock phosphate has been making some headway in Wisconsin this year and there seems to be considerable interest in its use.

Iowa—P. E. Brown, professor of soils, Iowa State College, thinks that 1929 will show a total utilization of agricultural limestone of about 450,000 tons. This is an increase of about 100,000 tons over 1928 in which year final figures showed that about 350,000 tons were used. (In this connection a correction should be noted concerning last year's review. The estimate which was made last year prior to the compilation of definite figures county by county proved to be too great.)

Professor Brown says that local crushers play an important part in Iowa's supply. He thinks there are about 200 such plants supplying limestone to varying numbers of farmers and in varying amounts.

As to cost, Professor Brown, says that the price is exceedingly variable because the freight charges are so different. It may be noted in this connection that Iowa has an agricultural limestone freight scale which starts with a very low figure for a very short mileage block and mounts rather rapidly with short mileage steps, thus while exceptionally short hauls enjoy a distinctly low price, the average haul more than makes up the difference. The price, f.o.b. quarry, ranges from $1.00 to $2.00 a ton.

Professor Brown says that the material used in Iowa varies greatly in fineness and in quality.

The State College recommends that it should contain at least 60% "dust," and should have no particles "larger than a pea" in size; however, there is material on the market which will not meet these specifications. Some very coarse material has been used which has proven unsatisfactory and farmers are beginning to realize that they should have a finer product.

(Writer's note:—A supporting sidelight on Professor Brown's opinion comes from one of the commercial quarry operators in the statement that certain hard road construction contractors operating in Iowa have in a few cases established their own temporary stone-crushing plants and have accumulated a low grade by-product material containing coarse particles and impurities and have disposed of this to nearby farmers for little or nothing above the cost of hauling.

Missouri—O. T. Coleman, extension assistant professor of soils, Missouri College of Agriculture, thinks that about 300,000 tons of agricultural limestone will have been used in 1929. This represents a slight increase over 1928 for the state as a whole. Various sizes of stone are being used but the college recommends 10-mesh minus. Professor Coleman says that local pulverizers have been on the increase; one county alone (an exceptional one) has introduced six such outfits during the year. Professor Coleman thinks that the outlook for 1930 is good. The average cost of commercial material will range (according to size of material) from 90c. to $1.50 per ton at the quarry and apparently the average freight rate is about 90c. per ton.

Kansas—M. C. Sewell, associate professor of soils, Kansas State Agricultural College, reports about 41,000 tons of agricultural limestone used in that state during 1929. Some 17,000 tons of this consists of commercial shipments by rail and the remaining 24,000 was produced locally "on the farms." Standard specifications require all to pass a 10-mesh sieve. The average quality chemically will approximate 90% calcium carbonate equivalent. The use of agricultural limestone is increasing and the tendency is to buy more from the commercial producers rather than attempt to crush on the farm. Professor Sewell says that the average price will run from 50c. to $1.50 on track. (Note: This would seem to indicate that some of the material must be surplus by-product.) The year 1930 will probably see about 25% increase as compared with 1929, if conditions are normal.

Nebraska—D. L. Gross, extension professor of agronomy, Nebraska College of Agriculture, says practically no agricultural limestone is used in that state and probably will not be in the near future. He says that lime is of benefit only on isolated fields so far as Nebraska soils are concerned.

Illinois—In the writer's own state 1929 was the banner year for agricultural limestone. A detailed survey county by county and company by company, although not quite complete, indicates a total use of agricultural limestone close to 950,000 tons during the year—this is nearly 150,000 tons better than 1925, in which year Illinois made the record for any state. These gratifying figures are attributable to several causes; first, agricultural limestone is a vital and foundation factor in the so-called "Illinois system of soil management," which has been stressed from the beginning by the Extension Depart-

ment and Farm Bureaus; second, the needs of the large cities, such as Chicago and St. Louis, the needs of the railroads which center in these two cities, the requirements for the extensive hard road program of the past few years, and the flux and chemical requirements of the large industries, have been the occasion for an extensive development of the quarry industry in and surrounding this state; third, there has been a favorable freight rate situation as a result of constructive efforts put forth in 1921; lastly, there has been in operation a mutually beneficial working agreement between the majority of the leading quarry operators and the Illinois Agricultural Association (Illinois state farm bureau).

As stated in the body of this review, Illinois is also the leading user in ground work phosphate, and 1929 is the best tonnage year since 1920—between 40,000 and 45,000 tons of ground rock phosphate were used by this state during the year 1929. A continued demand is expected for 1930.

Phosphate Rock Industry in 1929

By H. D. Ruhm

Vice-President, Ruhm Phosphate and Chemical Co., Chicago, Ill.

THE year 1929 has been one of marked progress in the phosphate rock industry, possibly more favorably affecting the Tennessee phosphate field than either of the other two working fields, Florida on the one hand or Idaho on the other.

The fertilizer industry has among its members at once the largest consumers of phosphate rock and the largest producers.

For many years the large producers in this great industry have aided and abetted in every way the efforts of those who are only consumers, to depress the price of phosphate rock as the chief raw material of the industry, ignoring any value as a primary product.

Phosphate Rock Deposits Are Chief Assets of Fertilizer Manufacturers

These efforts on the part of consumers are easily understood, but it is hard to understand the big producers doing this. Lately they have apparently awakened to the fact that the largest values underlying their securities are deposits of phosphate rock and that unless the price for this material pays a profit above carrying costs, they must continue to show the condition reflected by the prices of those securities, which even bull markets failed to advance. The receiverships, reorganizations and other similar distressed conditions can be traced to this primary trouble.

Such an awakening is evidenced by the firmer price situation that has shown a gradual healthy improvement throughout the year 1929.

At the same time has come a consciousness that the extremely high pressure salesmanship of nitrogen and potash producers has been tending to make the industry forsake the "rock of its salvation," and the same awakening has been bringing more forcibly to their minds the fact that through the ages the crying need for economical creation of soil fertility has been phosphate and lime.

They are realizing that the more they stress phosphoric acid and lime, the more they build up their own resources instead of foreign producers and the better job they do for the farmer consumer.

Rapid Growth of Furnace Consuming Trade

The next largest consumer of phosphate rock is the furnace trade for producing phosphoric acid in electric furnaces, and the addition of phosphorous to iron in blast furnaces.

This trade can only use lump phosphate rock and has grown very rapidly in the past two years, taking high grade material at very satisfactory prices, which must go higher unless some proper briquetting process is developed to utilize the fines which form by far the largest portion of Tennessee deposits.

Direct Use in Agriculture

The third consuming trade which is so far the smallest in tonnage, is the direct application of the finely ground phosphate to the soil, and this has had a most surprising growth.

For many years this use was only recommended by a few state agricultural experiment stations and the prices were held at about the raw material price levels referred to in the first paragraphs, so that with no margin for selling costs, a minimum amount was sold.

Experimenters in most states used only the same coarsely ground material which Liebig and Lawes had found 90 years ago had to be acidulated to be quickly enough available for development of a fertilizer industry.

Of course, the experimenters using such material got the same results the fathers of agricultural chemistry did.

Meantime, however, the producers of finely ground phosphate for direct use have long since realized that fineness of grinding is the true measure of quick availability measured in crop response.

State after state authority is finding when they experiment with the product of today, which is being sold under the new trade name of *lime phosphate*, contains 33% phosphoric acid, and is ground so fine that between 80 and 90% will wash through a 300-mesh screen with 0.0018 in. opening, they get the same satisfactory results as the rapidly increasing number of farmer users have been securing in the few states where commercial sale of this product has been gradually developing. Prices have improved with improvement of the product.

Lime Phosphate in Mixed Fertilizers

Until recently ground phosphate rock has been used for direct application almost if not entirely alone and most users have depended entirely on legume crops to get the necessary nitrogen from the air and potash from the insoluble potash salts in the soil.

Recently, however, lime phosphate has been successfully substituted pound for pound for acid or superphosphate in fertilizer mixtures of the three principal elements.

This is the most important feature in the improved prospect for the phosphate rock industry and with the recognition of this fact by the industry at large will come practically a doubled consumption of phosphate rock by the fertilizer trade instead of the continued threat of a reduction of that consumption which has largely influenced the big producers in their past low price ideas on phosphate rock as a raw material.

Operating Improvements

Many improvements in mechanical methods of handling and recovery, chief among which is the application of flotation processes, are recorded.

Three or four plants for chemical production "at the source" have been erected at or near the mines during the year and more are contemplated.

To sum up the situation, 1929 seems to be outstanding as witnessing the real beginning of phosphate rock "coming back into fashion;" and the next "bull market" is likely to be witnessed among the stocks of the big fertilizer and other companies holding the enormous deposits of this material which for so long has been "out of style."

Florida and Western Developments

IN THE Florida pebble phosphate fields hydraulic stripping continued to play an important part in reclaiming, although a new 8-yd. Bucyrus-Erie dragline at the operation of the Southern Phosphate Corp. near Lakeland was used for stripping and is evidence of a tendency toward this type of excavator.

Several of the phosphate companies in the past installed sand washers and reclaimed the waste sand for use in building purposes, but that practice has largely been abandoned, as sand was too low priced in that locality to make the operation profitable.

The United States Phosphoric Acid Co., Tampa, Fla., placed a by-product gypsum

calcining plant in operation during April of 1929. After leaching the phosphate rock with sulphuric acid a gypsum residue results. This mud-like residue is stockpiled and after draining slightly is fed to a single 10-ft. Ehrsam kettle and calcined without further drying, grinding or other preliminary treatment. Ehrsam hot-pit emptiers are used. The company manufactured some stucco for plaster, but most of its product went into the manufacture of tile. The gypsum stucco is said to make a very satisfactory tile.

Florida Fields Active

The International Agricultural Corp. is reported to have a large construction program mapped out for the coming year. The Southern Phosphate Corp. became part of the Davison Chemical Co., Baltimore, Md. The Florida Phosphate Mining Co. is planning some new operations at Phosmico, near Barstow and the Coronet Phosphate Co. opened a new mine on the Mulberry-Bartow road in the Tampa district. The American Agricultural Chemical Co. opened a new phosphate mine near Alafia, the construction including a new washer and dragline. The American Cyanamid Co. purchased 500 acres of phosphate bearing ground near Plant City and is reported planning to build a large superphosphate plant on deep water near Tampa and the Mutual Mining Co., Inverness, is expected to start shipping early in 1930. The Florida pebble field was more than usually active and its output was at least as great as in 1928.

There was considerable activity reported in the Idaho-Montana phosphate fields; the Keystone Phosphate Co., Paris, Idaho, is arranging for installing an aerial tramway to the railroad 1½ miles away and will install new grinding machinery at its plant.

The Idaho Phosphate Co., Nampa, Idaho, is reported to have started construction work on a crushing plant to prepare phosphate for shipment to the Orient. The Montana Phosphate Co., with properties at Garrison, Mont., was organized during the year for a similar purpose.

Installing Process to Recover Fines

The International Agricultural Corp. is reported to be providing for an enlarged productive program using the flotation process to recover fines now wasted. This company has been engaged in extensive research work during the past year and it is expected that by 1930 the industry may see important developments a a result of that work.

The Davison Chemical Co., Baltimore, Md., is reported to be entering an expansion program for its subsidiary, the Southern Phosphate Corp., Bartow, Fla. Plans include opening a deposit near Bartow and a second deposit in Polk county, the entire program to cost over $400,000 with conveying machinery, loading equipment, etc. The Davison company will also complete the construction of the fertilizer plant at Houston, Tex., that is said to represent an investment of $1,000,000.

PHOSPHATE ROCK SOLD OR USED BY PRODUCERS FOR THE YEARS INDICATED*

	Long tons	Value
1920	4,103,982	$25,079,572
1921	2,064,025	12,270,070
1922	2,417,883	10,482,846
1923	3,006,706	11,576,049
1924	2,867,789	10,252,083
1925	3,481,819	11,545,678
1926	3,209,976	10,893,800
1927	3,170,699	11,253,352
1928	3,439,921	12,339,850

*From United States Bureau of Mines, Department of Commerce compilations.

A stripping operation in the Florida phosphate fields

Asphalt and Bituminous Rock

THERE were six incorporations reported during 1929 for the production of rock asphalt, which is indicative of the interest in that material as a road surfacing material. This does not include incorporations to manufacture black top materials such as Amiesite, etc. The total value of the capital stock was given at $1,720,000, with four companies reporting stock of no par value.

The Utah Rock Asphalt Co., Sunnyside, Utah, is reported to have spent $75,000 on a new aerial tramway. This is its second year of operation. Thomas H. Bellrose is reported to be constructing a large plant for handling rock asphalt at Deerfield, Mo. The Gar-Rock Asphalt Co., Inc., took over the mills and quarries of the Garfield Rock Asphalt Co., Garfield, Ky., and is reported to have made extensive alterations to equipment.

Year	Short tons	Value	Value per ton
1923	400,236	$2,885,631	$7.22
1924	562,367	3,958,339	7.04
1925	584,850	4,148,400	7.10
1926	715,180	4,484,960	6.28
1927	839,040	5,605,850	6.68

Agate Found in an Old Abandoned Quarry

TO FIND SPECIMENS of agate in a trap rock quarry that is unknown for mineral deposits seems impossible. It is interesting to note, however, that while making observations of the Spottiswoode and Cusack trap rock quarry at Walker Road, Orange, N. J., about three years ago, I noticed an unusual formation of rock indicating remains of volcanic action. At the southwest corner of the quarry were observed large curved plates of hard, dark-green trap rock. But it was at the northwest corner of the quarry that I uncovered several specimens of weathered agate, some deeply pitted.

The discovery was by mere accident when a wasps' nest was disturbed and the angry pests started in for battle. At this position of defense, with the aid of a small branch from a hickory tree, I brushed away some damp leaves where the wasps at one time had their comfortable little home, when to my surprise I noticed a small fragment that resembled agate. My time was then devoted to research work regardless of a few straggling wasps that were out for vengeance. I uncovered 17 samples of the blue-banded variety of agate and they were taken to Mr. Cusack, at one time part owner of the abandoned quarry. His remarks were that many of the roadbeds in the Oranges were constructed with the rock from his quarry, possibly 25 years ago, and this was the first he knew of any minerals in the quarry.—Louis Reamer, Orange, N. J., in *Rocks and Minerals.*

Research in Aggregates in 1929

By Edmund Shaw
Contributing Editor, Rock Products

RESEARCH in aggregates before 1929 was almost wholly confined to studying the effect of those mechanical conditions generally called the characteristics of aggregate, such as maximum size, gradation, fineness modulus, cleanliness and freedom from segregation. Some study had also been made of the effect of varying percentages of voids. It will be noted that these are mainly attributes that may be given any aggregate material by the ordinary manufacturing processes, crushing, sizing and mixing.

The fact that aggregates had certain properties which were inherent, being properties of the materials from which they were made, had been generally ignored until 1929. But it has now become generally recognized that such properties as mineralogical composition, the shape of the pieces (as rounded, flat and angular), roughness, soundness, hardness, elasticity and porosity, to name only a few of many inherent properties, may affect the strength and workability of concrete as well as the characteristics mentioned above.

Unfortunately it cannot be said that any systematic study of these properties has been made or even begun. The most that can be said is that during the past year comparative tests of aggregates have been made to show their applicability to making concrete when used in certain proportions. And these tests have shown that the resulting concretes vary substantially in strength and workability, the variations being as great as those which would result from a considerable change in the water-cement ratio. It has been concluded from these tests that the inherent properties of the aggregates used were responsible for these variations, although which properties, and how much each was responsible, has not been satisfactorily determined.

Comparative Tests of Coarse Aggregates

Because of possible effects upon crushed stone and sand and gravel industries, interest in 1929 has largely centered upon the comparative tests of stone and gravel made in the laboratory of the National Crushed Stone Association by A. T. Goldbeck, and by the research department of the U. S. Bureau of Public Roads, reported by W. F. Kellerman. The papers describing these will be referred to as Goldbeck's first paper (Abs. April 27) and second paper (Abs. October 12) and Kellerman's report (Abs. July 6). The dates and other dates in parentheses which follow refer to the publication of the full paper or abstract in ROCK PRODUCTS. The originals in this case were published in the *Crushed Stone Journal* and *Public Roads*.

Detailed descriptions and discussions of these tests have already been published. But in an annual review of this kind it seems fitting to sum up the conclusions that have been drawn and to see how they stand in the light of further developments and the criticisms and comments that have been made upon them.

The first series of tests made and described by Goldbeck were on an equal number of crushed stone and gravel specimens. The stone specimens were selected to include the variations in hardness found in commercial limestone aggregates. The gravel specimens were not so chosen but there was an even wider variation among them. This gave an opportunity to compare the strengths of the concretes with the resistances to abrasion.

All concrete was mixed by a single arbitrary proportion, 1:2:3½. The results showed a variation in modulus of rupture from 720 to 517 lb., of compressive strength from 4300 to 3160 lb. and a variation in cement content from 5.77 to 6.34 sacks per cu. yd. The single conclusion Mr. Goldbeck was able to draw from this series was that such arbitrary proportions should not be used for concrete made of unlike materials, because, in the language of his report, "the use of identical proportions results in widely varying values for modulus of rupture and this causes lack of economy, considerable variations in the service value of road slabs and inequitable competition between value of road slabs and inequitable competition between the several aggregates." He judged however, that there was some connection between resistance to abrasion and flexural strength.

The Bureau of Public Roads tests, described in Kellermann's paper, were made by using just such arbitrary proportion mixes as Goldbeck's paper concluded with good reason should not be used. Fortunately for later comparison and analysis, four mixes, 1:1.6:3, 1:1.6:4, 1:2:4 and 1:2:4½, were tried and four gradings with each mix. Nevertheless, in the light of Goldbeck's results, no one of these could put the aggregates to be tested on an equitable basis.

In Goldbeck's second series (made on the same aggregates as the first) arbitrary proportions were discarded and an attempt was made to reduce the variables as much as possible by giving all samples the same cement content. The amount of coarse aggregate to be used was obtained by Talbot's formula, $b \div b_o = 0.775$. This method gave greatly increased compressive and flexural strengths, especially with the gravel concretes which had the low cement contents in the first series. But there was some evidence in the results to show that the method of proportioning was not suited to all samples, notably one badly graded stone sample which had 50% voids. This gave a lower strength with a higher cement content than in the first series, and it is hard to account for this in any other way than by saying that the mortar volume was too small for the voids, so that the mix lacked workability. (See ROCK PRODUCTS, October 12, for a discussion of this.)

Ratio of Mortar Volume to Voids

The necessity of having the ratio of mortar volume to voids in the coarse aggregate, in order to have strictly comparable results was pointed out by Stanton Walker, research director of the National Sand and Gravel Association, in his analysis of the Kellerman report. But he also pointed out that the 1:1.6:4 mix for gravel and the 1:2:4 mix for crushed stone did provide proportions that gave approximately 170% of the volume of the voids in the mortar volume. The cement contents were fairly close so he compared the results of these mixes. A different grouping of the concrete strengths of the different aggregates resulted. Especially noticeable is the new position of the silicious gravels, which were handicapped by having low voids and hence low cement contents in all arbitrary proportion mixes. In addition to making these comparisons, Walker gets an even better showing for these aggregates by calculating the strengths of all samples to exactly the same cement content.

Comparing the conclusions drawn by different investigators: Goldbeck concludes from his second series that, "the smooth, rounded surfaces of gravels seems to adversely affect the beam strength of concrete," also, "the quality of the aggregates affects the compressive and bending resistance of concrete but is more important in affecting cross-bending resistance." (By quality, apparently, is meant the resistance shown in the standard wear tests.) With the first conclusion the Kellermann report agrees in effect, but it finds no relation between resistance to wear and cross-bending strength within the limits of the tests.

Walker, analyzing the Kellermann report, finds no evidence that cross-bending strength is more affected than compressive strength

by the type of coarse aggregate, comparison being made on concretes with equal cement contents and equal mortar-voids ratios. On the same basis he finds a slightly *higher* cross-bending strength for aggregates with rounded surfaces (and low voids). But he agrees with the Kellermann report in finding no relation between cross-bending strength and resistance to wear.

The Kellermann report concludes that mineralogical composition is an important factor, calcareous aggregates showing higher strengths than silicious aggregates. Goldbeck's conclusions do not touch upon this point. Walker's method of comparison does not show this definitely, and he concludes that there is no information available to definitely identify those inherent properties of aggregates which cause such variations in strength as are shown.

As the matter now stands, there is no conclusion that has been drawn from all this testing and reporting that has not been questioned with good reason, or ignored, as in the case of Goldbeck's conclusion about arbitrary proportions. The single gain that has been made is a recognition of the fact that certain inherent properties of aggregates affect the strength and workability of concrete more than was supposed, and the need of more research for our better understanding of the factors that govern the strength and workability of concrete is even more apparent than it was at the beginning of the year.

Aside from the theory, there is the important practical result that these tests point a way to design concrete mixes so as to take advantage of or minimize the effect of certain properties and characteristics of aggregates. The theory that the mortar should be in proportion to the voids is one of the things that is being studied by an American Society for Testing Materials committee, and C. Gray, district manager of the American Aggregates Corp., has recently proposed a specification for putting this in practice. (Abs. December 7.)

Round Versus Angular Shapes

The point of greatest interest, however, is the effect of the shape of the pieces of coarse aggregate on the flexural strength, highly important because of the use of aggregates of different types in concrete paving. Considerable work by different testing bodies is being carried on to determine the effect of shape. At the June A. S. T. M. meeting it was announced to the concrete and aggregate committee that the Bureau of Public Roads is carrying on a long series of tests in which 200 beams made with rounded aggregates and 200 made with angular aggregates will be broken. The results are expected to be ready for report at the coming meeting of the society.

Association Papers

Three papers were given in an appendix to the report of this A. S. T. M. committee, which should go far toward settling some vexed questions concerning the quality of certain aggregates. The first was on the effect of stone dust on concrete, by A. T. Goldbeck, and it was a digest of the fuller report presented by him at the annual meeting of the National Crushed Stone Association (February 2). The second was a paper on the effect of flat particles on the gravel making properties of concrete, by Stanton Walker and C. E. Proudley of the National Sand and Gravel Association. It was shown conclusively that there was no decrease in compressive or flexural strength when the flat particles were as much as 14% in fine gravel and 10% in coarse gravel. An additional point brought out that while the concrete strengths were not affected by the addition of flats, the percentage of wear in the abrasion test on the whole coarse aggregate was greatly increased. The third paper, by J. R. Freeman, treated of the effect of lignite in sand for concrete. This confirmed the work of Morrison and Webb, and showed that the effect of lignite in amount equal to 0.05% was to lower the strength of concrete about 8%, and that the effect was increased only a little when the lignite content was increased to 1%. Decomposed coal had the same effect as lignite.

An entire session of the June A. S. T. M. meeting was given to an aggregate symposium. (Abs. July 6 and September 14.) Although little was brought out concerning the effect of those properties of aggregates about which there are important differences of opinion, one paper, that of F. C. Lang, of the Minnesota State Highway Department, did attempt to definitely connect the inherent properties of coarse aggregates with their concrete making properties. The evidence was taken from a number of published series of tests most of which were made with other ends in view. It was concluded that the only effect of resistance to wear is to disclose the weak structure of certain aggregates, and that ordinarily there is no connection between wear and concrete strength. The same was found true of the properties toughness and hardness. Absorption was found not to affect concrete strength, reports that it had done so in some cases probably coming from the effect of absorption in lowering the water-cement ratio. It was judged there were not enough data available to show whether or not there was a difference in flexural strength due to the shape, as smooth and rounded or rough and angular.

But the paper of McMillan and Ward, of the Portland Cement Association, showed there was a very close connection between the inherent properties of aggregates and the durability of the concretes made from them. The same is true of the fire-resisting properties of concrete, as brought out in a paper by S. H. Ingberg, of the U. S. Bureau of Standards.

Fine aggregates received unusual consideration at this session, not only fine aggregates in concrete, discussed by H. F. Gonnerman, but in bituminous mixtures (papers by H. W. Skidmore and Prevost Hubbard) and in mortar and plaster (J. C. Pearson). The first was largely given to the effects of size and grading of fine aggregates and both American and European authorities are cited. The second shows that the makers of bituminous mixtures have the same problem as the makers of portland cement concrete in aggregate research, complicated by the effects of different fillers. The stability and strength of bituminous mixtures seem quite definitely to be influenced by the shape and surface texture of the aggregates. In comparing different fine aggregates in mortar and plaster making, about the only definite conclusions made were that existing specifications for plaster sands debar many suitable sands and that satisfactory specifications can hardly be written until relations are established between the characteristics and properties of aggregates and the plasticity and volume change of mortars made from them.

So much interest is taken in the use of aggregates in concrete and bituminous mixtures that their other uses have been somewhat neglected. Two good papers in the symposium mentioned dealt with other and important uses, one, by C. N. Conner, treating of aggregates as material for low cost roads with untreated surfaces. The paper shows the need of simple standard test for determining the suitability of aggregates for a purpose. The other, by Herbert F. Kriege, discusses in great detail the use of aggregates in trickling and contact filters, and for railroad ballast. This paper is especially valuable because in addition to tables drawn from experience and laboratory tests it has such a discussion of these that it goes a long way toward enlightening producers on subjects about which they have not much information.

At the American Concrete Institute meeting several papers treated of aggregates and their uses although none of them dealt with research, unless one would include some excellent papers on the design of concrete mixes. The important thing in this meeting was the tentative adoption of a national specification for concrete aggregates. As most of the members of the committee which framed it serve on similar committees of other specification making organizations, it is probable that an identical specification will finally be adopted by all such bodies so that eventually there will be a single national standard for aggregates as there is now for portland cement. Naturally such a specification will deal with only the most essential things.

Important Papers and Articles

A number of papers and articles on aggregates have been published during the year. Most of them, while they are of great

importance to the aggregate producer, are not concerned with aggregate research in the strict meaning of the word. Such are the papers of the American Concrete Institute meeting, already mentioned, the compilations of specifications made by the National Sand and Gravel Association, J. F. Kitts' article on standardized sizes (June 8) and the article on the practical use of aggregates by Stanley M. Hands (December 7). Of the articles mainly given to research, five or six stand out prominently.

One that has added much to our knowledge of the ordinary characteristics of aggregates is the paper on the relation of grading to concrete, by A. T. Goldbeck (Abs. August 17). Following publication of the work of the National Crushed Stone Association and the National Sand and Gravel Association laboratories on the relation of voids to grading, a demand arose among some engineers for coarse aggregates so graded as to produce the lowest maximum voids. To produce such material would require the discarding or recrushing of intermediate sizes, a considerable part of the crusher run in the case of stone, or, the pit run in the case of gravel. Goldbeck's tests showed that considerable amounts of the intermediate sized product could be included without raising the percentage of voids more than 2½%. The concrete made from these gradings had equal or better strength than that made with the minimum voids aggregates and the difference in cement content was small. The slight difference in cement would be more than offset by the cost of making special low-voids aggregates.

In another paper Goldbeck describes his work at the National Crushed Stone Association laboratory on the sodium sulphate test for soundness and the freezing and thawing test. In this long and very detailed report Goldbeck shows conclusively that too many variations are possible with the standard sodium sulphate test to make it reliable. Also that its results are not comparable with the actual freezing and thawing which it has been supposed to simulate, and he describes a new method and apparatus for the freezing and thawing test which is fast enough so that the only excuse for using the sodium sulphate test is gone. As the sodium sulphate test has been under suspicion for a long time, no one will be sorry to see it discarded, as this paper shows that it should be. But it should be retained and used with the strict procedure outlined by the paper wherever freezing and thawing methods are not available, as soundness has been demonstrated to be the most important property of aggregates from the point of durability of concrete.

George Adams Roalfe, in the article already referred to (September 28) describes some research that is out of the ordinary lines on the effect of coarse aggregate materials on compressive strength. To make the comparison striking, unfamiliar materials like cork and steel slugs were used, the grading being the same in all cases. The results were compared with the compressive strength of the mortar used with the coarse aggregate, taken as 100%. The tests showed 12.8% for cork, 36.6% for steel slugs, and 61.4% for crushed rock, and Mr. Roalfe concludes that it is preposterous to assume that all aggregates that are clean and sound will produce uniform results. He has shown the writer privately results from other commercial aggregates than the crushed rock mentioned, which indicate that wide variations are due to the type of aggregates as were found in the Bureau of Public Roads tests.

An abrasion test for sand, worked out by the Bureau of Public Roads, is described in an article by D. O. Woolfe (Abs. April 13). Combining sizes to a standard grading eliminates the greatest factor of variations in abrasion tests. Tensile strength was found to have no connection with abrasion, but resistance to freezing and thawing was found to follow it. Mineralogical composition appeared to account for differences in wear, and a percentage of wear of 9 or less is satisfactory for paving concrete. The report is interesting in that it points a way to use definite terms in place of the vague specification that requires concrete sand to be of "hard and durable" particles.

J. C. Pearson (May 11) describes a simple absorption test for sand that can be made quickly and requires no more apparatus than a bottle and a burette. This is of great practical importance now that there is so much designing of mix by the water-cement ratio method, with allowance for absorption.

Foreign Research

It is evident enough that interest in aggregate research is not confined to the United States from the papers that have appeared in foreign periodicals. The German paper *Zement* published a series that ran through four issues for a total of 130 pages. The whole was abstracted in Rock Products, November 9, but of course from such a condensation one can gain only an incomplete idea of the work.

Judging from the abstract, the effect of size was studied more than anything else, although it was noted that several other characteristics and some inherent properties of aggregate affected concrete strengths. For the same water-cement ratio, no uniform change in strength was found with ordinary changes in gradation, although a tendency was noted for the strengths to run higher with the coarser materials. For mixes of the same consistency, coarser aggregates gave higher strengths as the water-cement ratio was lower. Starting with a 100% sand mortar, coarse aggregate was substituted for sand and the cement content decreased 35 to 40% without loss of strength or workability. Eight per cent more sand (as from 45 to 53%) was found to be needed with crushed stone than with gravel. This and much more that is mentioned agrees with the conclusions of American investigators.

In another *Zement* article, abstracted in Rock Products, November 23, there is a discussion of the reactions between portland cement and aggregate minerals, a subject which has received very little attention.

Tonindustrie-Zeitung article (Abs. April 13) describes Russian research on the effect of fines in sands. The addition of finely powdered quartz to sands gave higher strengths to lean mortars but did not increase the strength of 1:3 mortars. A shortage of two 5 mm. to 2 mm. sizes of sand was found to have an unfavorable effect on strength.

Future Research

A considerable amount of research in aggregates will be undertaken in 1930. Some of this has already been mentioned. One series of tests that is bound to have considerable influence on both the aggregate industry and highway construction is now being carried on at the Arlington proving grounds of the Bureau of Public Roads (Abs. September 14). There are to be 250 paving slabs laid by standard equipment, using three types of coarse aggregate, two gradings six proportions and two consistencies. Core and beam tests will be made.

Asbestos in 1929

THERE WERE three incorporations in the asbestos industry reported in 1929 that totaled $30,523,000. The large total is due to the formation of the Raybestos Manhattan Co., having a capitalization of $30,000,000, and was the result of a merger of the United States Asbestos Co., the Raybestos Co. and the Manhattan Rubber Manufacturing Co. The Panhandle Asbestos Co., Kamiah, Idaho, was sold during the year at a sheri's sale to satisfy a judgment of $1,600.

Experiments were conducted in Canada in an attempt to use waste from the asbestos mines as a corrector for acid soils. So far reports are conflicting as to its value for that purpose.

Following are the production statistics for asbestos the past six years:

	Domestic Production			Imports		
Year	Short tons	Value	Value per ton	Short tons	Value	Value per ton
1923	227	$ 9,626	$ 42.40	212,420	$7,445,143	$35.05
1924	300	42,526	141.75	183,250	5,602,945	30.60
1925	1,258	51,700	41.15	230,520	7,134,302	31.00
1926	1,358	134,731	99.20	257,621	8,142,505	31.60
1927	2,981	336,882	113.00	223,693	8,150,340	36.60
1928	2,239	351,178	157.00	230,595	9,017,891	39.10

Research in Sand and Gravel in 1929

By Stanton Walker

Director, Engineering and Research Division, National Sand and Gravel Association, Washington, D. C.

RESEARCH has continued to occupy a prominent place in the program of the National Sand and Gravel Association during the past year. While the accomplishments of research rarely loom large over a short period of time, the work which has been completed and which is under way offers undeniable evidence of the value to the industry of such activities. It is the policy of the association to direct its principal efforts to the development of information of general interest to the sand and gravel industry. However, it should be pointed out that the facilities of the laboratory are available to member companies and that studies of special problems, which may be of no general interest, have formed an important part of its work.

Present Studies

The principal activities in the laboratory have been in with studies of sand and gravel as a concrete aggregate, although much of the information developed will be helpful in studies of other uses. The more important problems, on which work has been carried out, may be summarized as follows:

1. Effect of the addition of finer sizes, such as pea gravel, to coarse aggregate on the strength and economy of concrete.
2. Effect of variations of the grading of sand and gravel, within specification limits, on its concrete-making properties.
3. Effect of variations in maximum size of coarse aggregate on the strength of concrete.
4. Effect of grading on void content of sand and gravel and the consequent effect on strength and economy of concrete.
5. Effect of flat particles on concrete-making properties of gravel.
6. Studies of methods of measuring the quality of gravel particles.
7. Studies of effect of mineral composition and shape of particles of aggregate on their concrete-making properties.

The statement that each of these investigations represents a problem of vital importance to the sand and gravel industry will be readily accepted. The smaller sizes of gravel are too often a drug on the market and specifications, in many cases, place unduly rigid restrictions on their inclusion in the graded material; variations in the grading of aggregate, even when these variations are within specification limits, are often a bone of contention between the producer and the user of the material; the recent tendency toward the use of larger material makes it desirable to determine what, if any, benefit is obtained by submitting it for the more plentiful aggregate of a smaller maximum size. The equally important bearing of the other questions listed will be seen readily.

Only a few of the data which have been obtained on these important questions have been published. The reason for this will become obvious on a little consideration. It will be seen that many of these problems are interrelated. For example, the information on the effect of adding finer sizes is supplemented by the data from investigations on variations of grading and maximum size, and, realizing this, the publication of the first data has been delayed until opportunity has been had to consider them in the light of the later investigations. In view of the status of the work and the other activities of the Engineering and Research Division, which have prevented a complete study of the data, it is not possible to give more than a brief summary of the test results.

Effect of Finer Sizes of Gravel

Gravel deposits, because of the method by which they are formed, often contain an excess of certain sizes limited by specifications based on the use of arbitrary proportions. The elimination of these sizes many times constitutes an economic waste which could be avoided by the proper design of the concrete. A common size to occur in excessive amounts is that generally known to the industry as "pea gravel." An increase in the amount of this size in gravel used for concrete would, in many cases, materially reduce the cost of production of the gravel and, what is more important in many localities, conserve the supply of rapidly diminishing material of suitable quality.

In order to obtain information bearing on this problem, an investigation was carried out in the research laboratory of the National Sand and Gravel Association using 40 different combinations of sand and gravel in concrete: 10 different gradings of gravel in four mixtures containing different proportions of sand. The 10 gradings of gravel were obtained by adding to ⅜- to 1½-in. gravel sizes passing a ⅜-in. sieve and graded down to a No. 4 or a No. 8 sieve. Compressive tests of 6x12-in. cylinders and transverse tests of 6x30-in. beams were made at 28 days of age. The yield of the concrete was also determined. Table 1 gives the data for certain of the gradings of gravel. Each value is the average of the results for 1-1½-4, 1-2-4, 1-2½-3½ and 133 mixes.

Space does not permit a detailed discussion of these tests. It is sufficient to point out that moderate increases in the amount of finer sizes have little effect on the strength, and that any reductions in strength obtained were accompanied by reductions in the cement required to produce a cubic yard of concrete.

Effect of Variations in Grading Within Specification Limits

Uniformity in grading within reasonable limits is an important factor in the production of concrete of a uniform quality. This is true whether the quality of the concrete is fixed by arbitrary proportions or by scientific design. In order to obtain information on what variations in concrete-strength may be expected on account of variations in grading of aggregates within the usual specification limits, a group of tests were made in which three gradings of sand and three of No. 4 to 1½-in. gravel were used. In each case these represented a fine, medium and coarse grading within the limits of the usual

TABLE 1. EFFECT OF FINER SIZES IN GRAVEL

Compression tests of 6- by 12-in. concrete cylinders.
Flexural tests of 6- by 6- by 30-in. concrete beams.
Specimens cured in moist room until tested at age of 28 days.
Each value average of 16 tests, four for each four proportions.

Grading of Gravel per cent of each size ⅜- to 1½-in.	No. 4 to ⅜-in.	No. 8 to No. 4	Water-ratio	Slump	Cement, sacks per cu. yd. of concrete	Strength at 28 days, lb. per sq. in. Comp.	Flexure
100	0	0	0.88	4	5.10	2700	505
80	20	0	0.93	4	4.97	2540	490
70	30	0	0.95	3½	4.98	2490	480
90	0	10	0.93	4	4.94	2440	485
70	20	10	0.96	3	4.93	2330	475
60	30	10	0.99	3½	4.89	2270	455
50	30	20	1.01	3½	4.89	2180	450

TABLE 2. GRADING OF FINE AND COARSE AGGREGATE

Sieve analyses of materials used in tests on effect of variations in grading within specification limits.

Sieve number or size	Size of clear opening, in.	Amount coarser than each size, per cent by weight: Sand Coarse	Sand Medium	Sand Fine	Gravel Coarse	Gravel Medium	Gravel Fine
100	0.0058	99	92	94	100	100	100
50	0.0116	98	87	70	100	100	100
30	0.0232	84	60	43	100	100	100
16	0.046	59	35	18	100	100	100
8	0.093	38	18	0	100	100	95
4	0.185	15	0	0	100	95	90
⅜-in.	0.371	0	0	0	85	70	55
¾-in.	0.742	0	0	0	60	42	25
1½-in.	1.5	0	0	0	5	0	0
2-in.	2.0	0	0	0	0	0	0
Fineness modulus		3.93	2.92	2.25	7.50	7.07	6.65

specifications for concrete aggregates.

The grading of the three sands and gravels are showin in Table 2. They were used in concrete of three different proportions. Two of the three proportions consisted of 1-2-4 and 1-2-3 arbitrary mixes; the third was proportioned in such a way as to require the same quantity of cement per unit of volume of concrete (about the average of that required for the 1-2-3 and the 1-2-3 mixes) for each combination of aggregate and to contain the quantity of fine aggregate which would produce satisfactory and approximately uniform workability. The cement contents and the compression and flexural tests are shown in Table 3. The relatively small variations in strength which are shown for these data, even for the extreme cases of the fine sand and fine gravel as compared with the coarse sand and the coarse gravel, indicate that the usual specification limits define a sufficiently narrow range to insure the production of concrete uniform in quality.

TABLE 3. EFFECT OF VARIATIONS IN GRADING OF AGGREGATE ON QUALITY OF CONCRETE

Compression tests of 6- by 12-in. concrete cylinders.
Flexural tests of 6- by 6- by 30-in. beams.
Specimens cured in moist room until tested at age of 28 days.
Each value is the average of four tests made on different days.

	Data for different mixtures and gradings of coarse aggregate											
	Sand 1-2-3				Sand 1-2-4				Sand designed			
	Coarse	Med.	Fine	Avg.	Coarse	Med.	Fine	Avg.	Coarse	Med.	Fine	Avg.
Water-ratio:												
Coarse	0.75	0.81	0.84	0.80	0.82	0.90	0.95	0.89	0.82	0.85	0.87	0.85
Medium	0.79	0.81	0.86	0.82	0.85	0.90	0.94	0.90	0.82	0.84	0.86	0.84
Fine	0.86	0.90	0.92	0.89	0.90	0.94	1.00	0.95	0.81	0.84	0.87	0.84
Average	0.80	0.84	0.88	0.84	0.86	0.91	0.96	0.91	0.82	0.84	0.87	0.84
Flow:												
Coarse	179	180	179	179	180	180	178	179	180	180	179	180
Medium	180	180	178	179	180	179	180	180	180	180	180	180
Fine	181	186	183	183	182	181	178	180	182	180	180	181
Average	180	182	180	181	181	180	179	180	181	180	180	180
Yield:												
Coarse	5.87	5.77	5.74	5.79	5.06	4.95	4.91	4.97	5.45	5.37	5.35	5.39
Medium	5.84	5.79	5.73	5.79	5.04	4.96	4.94	4.98	5.35	5.34	5.40	5.36
Fine	5.82	5.73	5.71	5.75	5.03	4.96	4.92	4.97	5.42	5.36	5.36	5.38
Average	5.51	5.76	5.73	5.67	5.05	4.96	4.92	4.97	5.41	5.36	5.37	5.38
Compression:												
Coarse	3040	2880	2840	2920	2620	2530	2225	2460	2785	2545	2710	2680
Medium	3280	3085	3065	3145	2645	2320	2385	2450	3060	2725	2930	2905
Fine	2830	2730	2870	2810	2260	1980	2395	2210	2840	2980	3205	3010
Average	3050	2900	2925	2965	2510	2280	2335	2375	2895	2750	2950	2865
Flexural:												
Coarse	535	515	500	515	550	465	475	495	535	515	490	515
Medium	545	550	515	535	550	515	500	520	535	515	535	530
Fine	545	490	520	520	510	495	490	500	570	560	555	565
Average	540	520	510	525	535	495	490	505	550	530	530	540

Effect of Maximum Size of Aggregate

It is believed that the report of certain researches carried out during the past several years have tended to over-emphasize the beneficial effects of using larger sizes of coarse aggregate. In order to obtain further data on this question, compression and flexural tests of concrete were made using four different sizes of gravel, ranging from a maximum size of ⅜-in. to one of 2-in. The different sizes of gravel were used in three different concrete proportions, two of which were arbitrary mixtures (1-2-3 and 12-4) and the third, a designed mix similar to that described above. The results of these tests are summarized in Table 4.

While it will be observed that, particularly in the case of the designed mix, a considerable range in strength was shown as between the aggregate with ⅜-in. maximum size and 2-in. maximum size, it should be pointed out that the increase in strength obtained by using a 1½-in. gravel instead of a ¾-in. gravel was not great.

Effect of Grading on Voids

Comprehensive information has been obtained on the effect of the grading of sand and gravel on its void content. One gravel and two sands were tested. In general, each of these materials are divided into three different sizes, which were recombined into approximately 50 combinations, in such a manner as to provide data from which the void content of any combination of the three sizes can be determined by interpolation. These data may not be reported readily in an understandable manner without the assistance of diagrams and rather detailed tabuations. It is therefore impracticable to include them in this brief review. The following observations made from the tests should be of interest, however, and guide the reader in a more detailed study of the data which will be published by the association in January, 1930:

1. For three sizes of gravel, such as used in these tests, the least voids were obtained for a combination of the fine and coarse sizes with the intermediate size omitted. In general, about 30 to 40% of the finer size gave the least voids.

2. Combinations of two adjacent sizes, that is, fine and medium or medium and coarse, showed relatively small changes in void content for different proportions. However, as in the case of the fine and coarse sizes, a combination of adjacent sizes containing about 30 to 40% of the finer size had a lower void content than other combinations of two adjacent sizes.

3. The general observation is made that for the sizes used in these tests the void content in any size or combination of sizes was reduced by the addition of a finer size up to about 40%, or of a coarser size up to about 60%.

The practical application of information of this nature will be realized when it is considered that the quantity of cement required for a unit volume of concrete is dependent upon the void content of the fine and coarse aggregate, so long as proportions of materials are maintained the same.

TABLE 4. EFFECT OF SIZE OF COARSE AGGREGATE

Compression tests of 6- by 12-in. concrete cylinders.
Flexure tests of 6- by 6- by 30-in. concrete beams.
Specimens cured in moist room until tested at age of 28 days.
Each value average of 16 tests, four for each four proportions.

Size of coarse aggregate	Water-ratio	Flow	Cement, sacks per cu. yd. of concrete	Strength, lb. per sq. in. Comp.	Flex.
1-2-3 mix:					
No. 4, ⅜ in.	0.93	180	5.88	3030	500
No. 4, ¾-in.	0.88	178	5.87	3220	505
No. 4, 1½-in.	0.81	180	5.79	3085	550
No. 4, 2-in.	0.81	183	5.72	3175	560
1-2-4 mix:					
No. 4, ⅜-in.	1.03	180	5.09	2050	440
No. 4, ¾-in.	0.97	180	5.06	2340	465
No. 4, 1½-in.	0.90	179	4.96	2320	515
No. 4, 2-in.	0.86	180	5.03	2855	495
Designed mix:					
No. 4, ¾-in.	.06	179	5.36	2220	430
No. 4, ¾-in.	0.93	180	5.32	2590	500
No. 4, 1½-in.	0.84	180	5.34	2725	515
No. 4, 2-in.	0.78	181	5.34	3045	540

Effect of Flat Particles on Concrete-Making Properties of Gravel

Early specifications commonly required that gravel be free from flat and elongated pieces. More recent specifications have revised this requirement to "free from injurious amounts, etc.," but in only a few cases are any suggestions made as to what constitutes injurious amounts.

The question of the effect of flat particles in quantities somewhat larger than usually permitted arose in an important producing locality. In order to obtain information on this question, compression and flexural tests of concrete were made using gravel containing flat particles up to about 14%. These tests, which were carefully controlled and fairly comprehensive in nature, failed to reveal any reduction in strength due to the presence of the flat particles. Careful studies of the surface texture of vigorously finished slabs in the laboratory failed to indicate any likelihood that the flat particles would have a tendency to float to the surface during the finishing process and arrange themselves in such a way as to be broken out by traffic. A detailed report of this investigation appears in the 1929 *Proceedings* of the American Society for Testing Materials and in the July, 1929, issue of the *National Sand and Gravel Bulletin*.

Tests of Quality of Gravel Particles

Concrete aggregates are required to consist of hard, strong and durable particles,

but no entirely satisfactory methods have been developed for determining whether the particles of aggregate have sufficient hardness and strength or will be durable on exposures to the action of the weather.

In connection with studies of gravel ballast the research laboratory of the National Sand and Gravel Association has experimented with different methods for determining the quality of gravel particles. Particular attention has been paid to crushing tests of gravel. These tests are made by applying a load to a sample of graded gravel confined in a cast-iron cylinder equipped with a loose-fitting piston. The results of these tests are being compared with Deval abrasion tests made on samples of the same grading as used in the crushing tests. Preliminary tests are also being made to determine a more definite measure of the effect of the action of sodium sulphate in the accelerated soundness test may be indicated by use of the abrasion test in conjunction with it.

Effect of Mineral Composition and Shape of Aggregate Particles

Recent investigations have shown that certain aggregate characteristics, which may be defined by mineral composition, surface texture, absorption or similar properties, may have an important bearing on the strength of concrete, particularly the flexural strength. Results of tests which have been carried out to date are somewhat inconclusive and it has been considered desirable to obtain further information on this question. Only a few tests have been carried out in our laboratory, but a large number of samples for test have been collected.

While no conclusions can be drawn from our own data, it should be of interest to point out the results of our analyses of data contained in a recent report on "Effect of Type of Coarse Aggregate on the Strength of Concrete," which appeared in the June, 1929, issue of *Public Roads*. If these data are analyzed in such a manner that comparisons among different aggregates are made for concrete containing the same amount of cement per unit of volume and mortar in proportion to the void content of the coarse aggregate, the following conclusions may be drawn:

1. Flexural strengths using aggregates with rounded particles are at least as high as those obtained with angular particles.

2. Compressive strengths obtained with aggregates having rounded particles are generally higher than those obtained with angular particles.

3. While it is evident that considerable variations in strength of concrete are obtained on account of differences of aggregate characteristics, it is not believed that available information definitely identifies factors causing the variations.

4. The compressive strength is affected by the type of aggregate at least as greatly as the flexural strength.

It was pointed out early in this report that an important part of the value of the laboratory to the industry has come from special investigations made on behalf of member companies. In most cases, these are not of sufficiently general interest to make it desirable to report the results. However, some mention of the nature of such tests, generally routine in nature, should be of interest. They have included comparisons of the economy of different materials; preparation of tables of quantities of materials to apply to specific aggregates; determination of various physical characteristics included in specification limits; investigations of uniformity of quality of the output of a plant; studies of the quality of material from undeveloped deposits; studies of test methods employed by member company; determination of suitability of aggregates for special purposes, such as filtration, engine sand, abrasion, etc.

The researches which have been carried out and which are under way on the problems discussed here will not furnish complete information. Further studies, which will be guided by those under way, will be conducted. The work which has been discussed may, therefore, be considered as an outline of our principal activities for the coming year.

Developments in the Cement and Aggregate Industries

By P. J. Freeman

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THE year 1929 has not seen any unusual developments in the uses of cement and aggregates with a possible exception of the increased demand for high early strength concrete, which will reduce the time between the dates of placing the concrete and using the finished structures.

The writer has observed a number of developments which are in themselves rather unimportant, but taken as a whole they show that there has been definite progress in the knowledge pertaining to the uses of cement and aggregates.

Portland Cement

Committee C-1 of the American Society for Testing Materials has been studying specifications for portland cement and will probably recommend an increase in the requirements for tensile strength of briquetts and a reduction of the ages for testing from 7 and 28 days to 3 and 7 days. Such specifications have not yet been adopted by the society and are therefore inoperative at this time, but the indications are that people using cement will demand an increase in its strength at early ages.

An unusual demand may be noted for high early strength cement which will produce a concrete having a compressive strength at the age of 3 days equal to that of ordinary portland cement at the age of 28 days.

Some state highway departments and municipalities are purchasing high early strength cement under the usual requirements for portland cement with the exception that the following minimum strength shall be met:

Tensile strength 1 to 3 Ottawa sand at one day equals 275 lb.

Tensile strength 1 to 3 Ottawa sand at three days equals 375 lb.

The SO_3 content permitted under the standard specification for portland cement is usually raised to a limit of 2.50.

Construction authorities are becoming insistent that less time be required for curing concrete before it is subjected to service, both in bridges and in pavements. The benefit to the traveling public of being able to use a road in two or three days in place of a considerably longer period cannot be denied, and the financial advantage which a contractor obtains by removing his centering in a few days is so great that some contractors are willing to purchase high early strength cement at an additional cost over ordinary portland cement and bear the additional expense themselves.

Many people are also using high early strength concrete made by the use of additional ordinary portland cement and limiting the water used for mixing. The writer has observed a very decided change in the attitude of constructors during the past year towards a desire and willingness to use every possible method available for expediting construction, both in the summer and winter.

Investigations and Tests

The U. S. Bureau of Public Roads has been conducting an investigation of various materials used for concrete aggregates in which the shipment in two sizes was made in order to obtain more uniform gradation. These tests promise much for economy in construction of concrete roads.

TRANSVERSE TESTS—The use of the transverse test for determining time of opening of pavements is becoming well established and it is now considered to be a fact that compressive and transverse strengths do not go hand in hand, but some aggregates which give very high compressive strengths may give comparatively low strengths in cross-bending. The various associations in-

terested in slag, stone and gravel are giving serious study to this particular subject at the present time.

SOUNDNESS TESTS—The soundness of coarse aggregates continues to be an important subject and considerable work has been done in the past year on the sodium sulphate test in comparison with freezing tests. The sodium sulphate test has shown itself to be subject to many variations due to slight changes in the method of manipulation. These variations are so serious that they will reject a given material which may be accepted by tests made in presumably the same manner but actually with slight variations. It is possible to reject material which is known to be suitable for use in concrete, but on the other hand this test serves as a very valuable danger signal calling for an intensive study of the material in hand.

TESTS FOR SPECIFICATION LIMITS—Events during the past year have shown the danger of writing into specifications purely arbitrary limits for the so-called deleterious substances. In some cases such arbitrary limits have rejected materials which are known to have produced satisfactory concrete over a long period of years. There is a great need for determining absolute factors for incorporations in specifications for aggregates.

Considerable attention is being paid to determining what impurities in aggregates are harmful and what quantities may be permitted. A number of researches along these lines are being carried on but in general are not yet ready for publication. An example of such work is the report of Committee C-9 presented before the A. S. T. M. last June. In that report the writer presented some data showing the effect of specific amounts of lignite on the strength of sand mortars. Messrs. Walker and Proudley of the National Sand and Gravel Association presented a report on the effect of flat particles on the strength of concrete. The indications from these tests are that in so far as strength is concerned the damage from flat particles is more talked about than the results from tests would justify.

Further study should be made of the effect of flat particles in various kinds of aggregates and the investigation should not be limited to their effect on strength. It may be that for many purposes the existence of flat particles in concrete is entirely satisfactory but for other uses, both in concrete and bituminous mixes, there should be a proper limit established.

Batching Methods

The requirements which call for separating coarse aggregates into two or more distinct sizes are gradually receiving consideration, but rather slowly. The only state highway department requiring separate aggregates with which the writer is familiar are North Carolina, New Jersey and California. Several other states are seriously considering such requirements, and it seems quite probable that eventually aggregates will have to be separated and shipped in two or more different sizes. The manufacturers of batcher plants are earnestly working to develop a complete and satisfactory set of equipment for handling such graded aggregates, and when such equipment is generally available, other organizations will be ready to specify their use.

During the past year the weighing of aggregates has become very common practice and the future projects built under federal aid will be required to use weighing batchers. After such equipment has become common practice the step to separation of various sizes of aggregates will undoubtedly follow.

Aggregates

Specifications for aggregates are directing attention to a greater degree of cleanliness and the elimination of undesirable particles. Requirements for washing crushed stone are becoming quite common.

A decided effort is being made in various localities to eliminate the unnecessary sizes of aggregates. The United States Department of Commerce is offering co-operation to aggregate producer organizations which desire to eliminate specifications which require an unnecessary number of sizes, and will send representatives to foster co-operation between the producers and users of such materials.

In the Pittsburgh district alone the producers are required to furnish the customary 57 varieties of gravel and a serious effort is being made to cut these down to a small fraction of this number.

An important development in the blast-furnace slag industry for the year 1929 has been the publication of nineteen symposiums by the National Slag Association. The publications have involved an unprecedented amount of care and labor and each one shows an abstract of all the known printed information concerning some one quality, characteristic, or use, of blast-furnace slag. The information as to slag has never before been assembled in completely accessible form and these publications furnish a convenient reference of great value to those interested in the various uses of blast furnace slag.

Another development has been the completion of the report on the investigation of blast-furnace slag as a material for filter beds for sewage disposal plants. This investigation including examination of more than fifty sewage purifying beds of slag and other materials is expected to be published in the near future and the use of slag in filter beds offers prospectively large possible markets for blast furnace slag.

LIGHT WEIGHT AGGREGATES—The survey would not be complete without mentioning the extension of the use of light weight burnt clay aggregates which are now available in sixteen states of the East and Middle West. The production of this material during the year 1929 will be about double that of the preceding year. This light weight burnt clay aggregate at present on the market has the trade-name of "Haydite" and is the material which was used in concrete ship-building during the war. It is manufactured from shale by burning in a rotary kiln similar to a small cement kiln. The material is pre-heated to vitrify the surface, after which the interior gases are caused to expand at a temperature of about 2000 deg. in a manner which produces a cellular structure.

Concrete made from this material is particularly suitable for roof and floor construction of buildings and has a weight of about one hundred pounds per cubic foot and a structural strength about the same as would be obtained from ordinary sand and coarse aggregate.

Future Needs for Aggregates

The development of airports throughout the country is so rapid that it is impossible to make a reduction as to the number or the area of such developments which may be expected during the next year. At the present time there are about 2000 airports in existence or under process of construction in this country, of which seventeen are larger than five hundred acres. Undoubtedly a great many more such airports will be laid out and developed. The problem of surfacing such an enormous acreage is without precedent in the history of engineering. The construction of satisfactory landing fields which will withstand the traffic from airplanes in the future will require the combined studies of our best highway engineers, as well as experts in the development of drainage areas.

Many airports are now covered with turf and such material helps to solve the immediate problem because our engineers do not have at hand a precedent and definite knowledge as to what should be done to provide for probable traffic conditions in the future.

An immediate and temporary solution of the problem for providing a more durable surface than turf seems to be in the use of bituminous bound runways and surfaces. For more durable construction higher types of runways are being constructed, using the very best kind of bituminous pavement materials and portland cement concrete. The amount of runways necessary for a large municipal airport will require as great a quantity of aggregates as would be needed for from 50 to 100 miles of pavement 20 ft. wide, and undoubtedly aggregate producers will find a large and profitable outlet for their production in the development of airports.

Low Cost Highways

During the past year there has been a marked tendency on the part of the users, as well as engineers responsible for highways, to consider the development of the so-called low cost or secondary highways. In order to vote bond issues for major highways, it is becoming necessary to com-

bine such issues with those for low cost roads. This does not mean that the construction of the higher types of pavements is being greatly restricted, but we may expect the construction of an enormous mileage of secondary roads to feed them.

Up to this time no concentrated effort has been directed towards the development of specifications and tests for such type of roads, but at least one of our engineering societies is beginning to realize the opportunities for service and the A. S. T. M. Committee D-4 is already attempting to perfect an organization for comprehensive study of the immediate problem of developing satisfactory specifications and tests to aid in the construction of low cost roads.

The engineers of the National Crushed Stone Association have already been studying the use of crushed stone in lower types of roads in connection with methods for obtaining the greatest stability possible for a minimum cost.

As an example of what may be expected, attention is called to the fact that the State of Missouri recently passed a bond issue for $40,000,000, under which that state expects to construct at least 5000 miles of secondary roads built under the direction of the state highway department.

The time seems ripe for the aggregate producers to work for the development of a secondary road system in the various states which will absorb an enormous quantity of road building materials which might not be exactly suitable for the highest type of bituminous and concrete road construction. There will undoubtedly be a hitherto unprecedented demand for such material, varying in quality from red-dog mine waste and cinders to the more expensive types of crushed and graded aggregates.

Feldspar Industry in 1929

CRUDE FELDSPAR sold in the United States in 1928 amounted to about 210,811 long tons, valued at $1,418,974, or $6.73 per ton, according to results secured from producers by the United States Bureau of Mines. Condensed tabulations of these results were published in the July 20 issue of Rock Products.

The condition of the feldspar industry during the past year can be summarized from a paragraph in a letter from an important producer, who says in part: "Last year 31 feldspar grinding operations reported production. Twelve of these plants could have supplied the entire tonnage, and as a result there was such competition for business that the price of spar went down to where the industry was making less than 5% on its investment."

Mergers an Important Factor in 1929

Due to the two mergers of major importance in the industry, conditions are apt to be somewhat improved during the forthcoming year. One of the mergers was that of the Consolidated Feldspar Corp., that was organized as the parent company of seven important producers in the United States and Canada and was one of the most important mergers in the feldspar industry. The companies included in the merger are the Golding Sons Co., Trenton, N. J., the Erwin Feldspar Co. of Spruce Pine, N. C., the Dominion Feldspar Co. of Canada and New York, the Maine Feldspar Co. of Brunswick, Me., the Isco Bautz Co., Inc., of Murphysboro, Ill., Feldspar Quarries, Ltd., of Canada, and Norman G. Smith Co. of Spruce Pine, N. C. It is possible that one or two more companies may enter the consolidation at a later date.

A second consolidation was that of the United Feldspar Corp., which acquired the capital stocks of the Tennessee Mineral Products Corp., Spruce Pine, N. C., the Oxford Mining and Milling Co., West Paris, Me., the Perham Crystal Feldspar Mines of Oxford county, Me., and the United States Feldspar Corp., Cranberry Creek, N. Y. The Roessler and Hasslacher Chemical Co., 10 East 40th street, New York, N. Y., are sole sales agents for the products of the merger.

The corporation has begun the enlargement of one of its plants and has plans under way to double the capacity of the Maine plant and install an aerial tramway from the quarry to the mill. The New York office of the United Feldspar Corp. is at 10 East 40th street.

In addition to the two companies incorporated in connection with the abovementioned mergers one other incorporation was recorded; that of the Southern Feldspar Co. at Bakersville, N. C. This company placed in operation a new plant at Toecane, N. C.

Plant Developments

The Feldspar Milling Co. placed its new plant at Burnsville, N. C., in operation this spring. This plant uses a Universal crusher as a primary reduction unit; Hardinge mills for the fine grinding, with Link-Belt vibrating screens as scalpers that send their oversize to a second set of Universal crushers for secondary reduction. The mill secures its raw material from ten pegmatites and from what is said to be one of the largest feldspar deposits in North Carolina.

The American Minerals Products Co., Inc., Walpole, N. H., was reported to be considering the construction of a grinding plant at Gold River to cost $160,000. Activities were reported at the Old Lick Mica and Feldspar mine at Spruce Pine, N. C. The Tennessee Mineral Products Co. is also reported to have undertaken some development work at two of its properties at this same place.

The Feldspar Grinders Institute, Inc., was organized by officers of the concerns interested in the grinding and selling of that commodity. The purpose of the institute is to foster friendly relations and co-operation of its members for the good of the industry. W. J. Parker was elected commissioner of the institute with offices at 7 East 44th street, New York City. One of the first fruits of this organization was the adoption of a code of ethics for the feldspar industry.

A second undertaking of the institute was the preparation of a commercial standard specification for feldspar in cooperation with the Bureau of Standards. Tentative specifications have been sent to the various producer members of the institute, and on January 14, 1930, a meeting will be held at the United States Bureau of Standards at Washington, D. C., to discuss these specifications.

The proposed commercial standards for feldspar briefly covers specifications for standardizing screens and methods of screen analyses and standardizing of chemical analyses also. Physical classification based on fineness of grinding and chemical classification based on composition as it influences its use are also part of the tentative standards.

By the adoption of these specifications the entire industry will be talking in a common and understandable language and litigation due to misunderstanding should be reduced to a minimum.

The following table shows the production and value for the years indicated:

Year	Long tons	Value	Value per ton
1924	204,772	$1,509,339	$7.51
1925	185,706	1,315,654	7.08
1926	209,989	1,607,101	8.00
1927	202,497	1,424,755	7.10
1928	210,811	1,418,974	6.73

Fuller's Earth

FULLER'S EARTH includes a host of natural substances, claylike by nature, that have the property of clarifying and bleaching oils, as well as for filling fabrics. The production for the past six years is given in the following table. More detailed statistics were published in the November 23 issue of Rock Products.

	Operators reporting	Sh'rt tons	Value of mines Total	Average
1923	15	149,134	$2,247,523	$15.07
1924	13	177,994	2,632,342	14.79
1925	14	206,574	2,923,965	14.15
1926	14	234,152	3,356,482	14.33
1927	16	264,478	3,767,038	14.20
1928	17	287,012	3,895,991	13.57

Research in the National Crushed Stone Association Laboratory

By A. T. Goldbeck
Director, Bureau of Engineering, National Crushed Stone Association, Washington, D. C.

IF ONE may judge of the plentiful supply of problems demanding investigation in the Bureau of Engineering of the National Crushed Stone Association, research has become an inseparable adjunct of the crushed stone industry. It is really surprising how little basic information exists on everyday specification requirements, and there is no more important phase of research at the present than that which will furnish real facts upon which common sense specifications for aggregates might be written.

All too forcibly the past season's work has demonstrated that great harm may be inflicted upon crushed stone producers by specifications the requirements of which have been arbitrarily selected. The determination of the proper limitation of the various kinds of deleterious substances in crushed stone is one of the most important pieces of research to be undertaken in our laboratory. Much has already been accomplished along this line.

Concrete highways seem to present innumerable problems, and the part that aggregates play in influencing the various properties of concrete is not at all well understood. The past several months brought to light much of value in showing that coarse aggregates have a very considerable influence on the qualities of concrete and particularly upon the beam strength, a property of high importance as it affects the resistance of concrete highways to cracking. Then, too, the secondary type of road is now becoming very prominent in the thoughts of highway engineers and many problems concerning the use of stone in such roads remain to be solved, particularly in connection with its use with bituminous binders, railroad ballast, sewage disposal and even fluxing stone all present problems to be undertaken by research methods. So the general field of research in the crushed stone industry is widespread and it holds many problems the solution of which would be of extreme value.

Work Accomplished During the Past Year

The laboratory of the association has now been in operation just a little over one year. It has had a very modest beginning and has operated with a very limited personnel consisting of one laboratory engineer and two assistants. By careful planning, however, they have accomplished a considerable volume of work during the past twelve months.

Gradation of Stone

The question of gradation of stone and its effect on the percentage of voids and on the compressive strength and modulus of rupture of concrete have been given study. At the last annual convention of the association the influence of gradation on percentage of voids was discussed. It was shown that the highest voids result in stone of a uniform size and that the lowest voids are obtained when a portion of the intermediate sizes of stone are omitted.

Such a result seemed to hold the possibility of compelling the stone producer to discard the intermediate sizes from his concrete stone and thus force him to find a market for this product elsewhere. Had these results been final many stone producers might have been inconvenienced and put to some trouble in disposing of this product. However, other tests were undertaken, this time involving not only void determinations but also the effect of varying voids on the strength of concrete. These tests showed that a rather wide variation in gradation in the intermediate sizes produces only a very small change in percentage of voids and, moreover, that neither the compressive nor the beam strength of concrete is materially affected by a comparatively wide change in the percentage of intermediate size of stone present. This is a happy result from the standpoint of the stone producer, for it shows him that he need not necessarily store up the intermediate sizes when producing crushed stone merely to obtain the absolute minimum percentage of voids. This investigation on voids and their effect on the strength of concrete was made for the purpose of obtaining information well in advance of the time when it may be badly needed. It has previously been brought to the attention of the industry that in at least one state stone is now required, in certain instances, to be shipped in separated sizes, later to be recombined at the concrete batching plant in the proper proportions. The U. S. Bureau of Public Roads has also been looking into the question of obtaining higher uniformity in concrete by the use of separated sizes of stone. It was thought well, therefore, to obtain information of our own on the effect of gradation.

Effect of Dust

Still another investigation which has been completed in a preliminary way during the past year has to do with dust coatings. Stone is often rejected because it contains a coating of stone dust and specifications are often written with a definite limitation on the amount of permissible dust. When stone is produced in wet weather it is a foregone conclusion that the dust resulting from crushing and grinding will adhere to the damp surfaces and form a film. Engineers raise the question as to the possibility of this film interfering with the bond between the stone and the mortar and tests were made to investigate this question and also to determine if the dust was brought to the surface of concrete by finishing and this might be more rapidly worn by the action of traffic. Briefly, the results showed no effect from the amounts of dust found in commercial crushed stone. In the tests approximately four times as much dust was used as would be found in a badly coated sample of crushed stone, and even with this amount of dust the deleterious effect was practically negligible. It should be emphasized, however, that the dust used was stone dust and did not contain any clay.

Kind of Aggregate and Beam Strength

Still another investigation which promises to be of high importance to stone producers has to do with the effect of various kinds of coarse aggregates on the beam strength of concrete. A great many state highway departments are now recognizing the importance of beam strength as a measure of the resistance of their concrete roads against excessive cracking and consequently it becomes important that we have a means for designing concrete so that it will have a desired resistance to cross bending. As a preliminary step in this investigation a number of commercial aggregates were procured and were made up into concrete proportioned by the old arbitrary volume method, using proportions of 1:2:3½ by dry loose volume. The results of this series demonstrated beyond question that the coarse aggregates play a very vital part in influencing the cross bending strength of concrete. They showed that the use of the same proportions, such as 1:2:3½ for stone concrete and for gravel concrete for road mixes will have widely different cross-break-

ing strengths, and that this method of proportioning cannot be defended. As a further step still another series of concrete tests were made using the same aggregates as before but this time the concrete was purposely proportioned so that all mixtures had the same cement content per cubic yard. Again it was demonstrated that the coarse aggregate played a most important function in their influence on the cross-breaking strength of concrete. It was shown that equal cross-breaking strength was not obtained when equal cement contents are used; and it was indicated that certain weak aggregates and certain highly polished siliceous gravels would require an increased cement content over that required by the angular rough aggregates in order that the same beam strength might result, thereby emphasizing still further the extremely illogical results which are obtained when arbitrary proportions are used.

As a third step in this investigation still another series of tests have been completed, but have not been published, in which an attempt was made to design the various concretes so that the same beam strength would result in all cases. No details of this investigation are possible at the present time, but within reason it has been found that concretes can be designed for given cross-breaking strengths on the basis of preliminary laboratory tests of the respective materials concerned. The results of this third portion of the investigation show that stone, instead of being unnecessarily penalized, as it has been in the past, by the old arbitrary proportioning method, may actually be proportioned with less cement than siliceous gravel aggregates.

Soundness of Aggregates

The question of soundness of coarse aggregates has been receiving a lot of attention in the past several years. Engineers are beginning to demand that the aggregates which they employ, either in sewage disposal work or for use as a coarse aggregate and in other types of construction be resistant to the weather or other influences to which it will be subjected. The sodium sulphate test for soundness has long been a favorite laboratory method. This test, however, has not been regarded as entirely satisfactory and in general it is suspected of being entirely too severe. A great deal of work has been done in the National Crushed Stone Association laboratory in investigating the sodium sulphate to test and also, in comparison with it, a special form of freezing test. It has been established that not only is the sodium sulphate test unusually severe, but it may cause stone to disintegrate which actually is sound, as proven not only by the severe experience but by its resistance to a severe freezing test which rapidly disintegrates unsound material. Moreover, it has been shown that various methods of manipulation of this test produce different results. The test, therefore, as at present conducted, is crude and is to be regarded only as a warning signal. It should not be written into specifications as a definite requirement. Co-operative work on soundness has been conducted with the committee on filtering materials of the Sanitary Engineering Division of the American Society of Civil Engineers and also with the committee on Concrete Aggregates of the American Society for Testing Materials on a special problem having to do with the properties of slag as a coarse aggregate in concrete.

In addition to these main research problems a number of smaller investigations have been conducted for individual producers to determine various matters in connection with possible deleterious effects of certain materials. For instance, freezing tests have been made on concrete containing stone which is known to disintegrate in the freezing test. The results obtained confirm those obtained elsewhere, namely, stone which disintegrates when subjected to freezing will not necessarily disintegrate when it is incorporated in concrete. It has been found that even with a stone which disintegrates badly when tested alone, the mortar surface will soften up and disintegrate without any apparent effect on the stone whatever. The subject of disintegration of concrete needs further investigation as it has been affected by so-called unsound materials.

The question of stone and sand has also been investigated in a preliminary way and a great deal of preparation has been made of stone sand samples which will shortly be made up into concrete.

Proposed Researches

For the coming year it is proposed to complete the investigation concerning the use of stone sand as a fine aggregate in concrete and to look still further into the question of proper design of concrete for beam strength as it is affected by the coarse aggregate. In view of the growing importance of bituminous mixtures, plans will shortly be formulated for the installation of bituminous testing equipment in the laboratory and several bituminous investigations will be undertaken. There are many problems in bituminous materials needing solution, not the least of which is that dealing with stability.

In concrete investigations there still remain many problems to be undertaken in which aggregates are concerned. One of these investigations which is definitely planned for is that concerning the effect of flat and elongated pieces. Several specifications have adopted an arbitrary limit of 5% for the permissible amount of flat and elongated fragments. This percentage eliminates stone from a number of well known and well established quarries from which material has been procured in the past, and which has produced concrete roads of the very highest quality. Investigations to determine the proper limitation cannot be anything but helpful to all concerned.

Studies of the soundness of rock will be continued with the idea of formulating a proper test for soundness. Co-operative work will continue in connection with the various committees dealing with aggregates including the newly formed committee on aggregates of the Highway Research Board of the National Research Council. No attempt has been made at this time to go into detail concerning our past or future work, but perhaps enough has been said to indicate the great need of continued research within the industry.

Graphite

THE PRODUCTION and value of amorphous and crystalline varieties of graphite are given in the following table. The complete statistics for 1928 on the production of graphite were published in the November 11 issue of Rock Products.

AMORPHOUS

Year	Short tons	Value	Value per ton
1924	4,071	$ 38,533	$ 9.45
1925	3,536	39,640	11.20
1926	2,975	40,500	13.60
1927	2,595	35,850	13.75
1928	2,994	43,320	14.40

CRYSTALLINE

Year	Short tons	Value	Value per ton
1924	900	$ 48,977	$54.40
1925	1,129	56,721	50.25
1926	2,495	178,842	71.50
1927	2,612	197,121	75.80
1928	2,617	253,773	96.80

The Southwestern Engineering Co., Los Angeles, Calif., which has done much of the pioneer work toward adapting the oil flotation process to graphite ores, operated a semi-commercial plant at Los Angeles during 1929 and successfully treated graphitic ores from the Saugus, Calif., district,using K & K flotation machines.

Opposition to Duty on Graphite

There was considerable opposition to the Senate action in revising the tariff by American importers, grinders and crucible manufacturers, who maintained that the proposed duties were burdensome, as the local graphite was unsitable for their purposes. They say that the American flake graphite does not compare in quality or price with the Ceylon or Madagascar products.

Since 1922 crystalline graphite has carried a duty of 20% ad valorem and flake graphite a specific duty of 1.5c. a pound. Before that time graphite carried no duty. The present bill proposes an increase in duty on the highest types of crystalline plumbago from approximately $29 a ton to around $44.80 per ton, and on the lowest grade from an average of $7 per ton to $44.80, an increase of over 600%.

Progress in Study of Quarry Costs

By J. R. Thoenen
U. S. Bureau of Mines

IN THE fall of 1927 the writer made inquiry of several operators of crushed stone quarries as to methods or ways in which the U. S. Bureau of Mines could be of most assistance to the industry. This led to the presentation of a proposed questionnaire for the study of quarry costs for consideration of the members of the National Crushed Stone Association assembled at West Baden Springs, Ind., in January, 1928. As a result the convention through its members expressed the desire for such a study and promised co-operation.

The questionnaire method for obtaining data was selected because of the obvious impossibility of the bureau personnel's visiting each of the many crushed stone plants throughout the country. Data collected by questionnaires are oftentimes not the most reliable, because no matter how carefully the inquiry may be worded it can seldom be so designed that only one interpretation is possible. Different operators viewing the problems from different angles make interpretations as they see them, and these interpretations are not all alike. However, the alternative—personal study of individual plants—being impartial, the questionnaire was made sufficiently elaborate to reflect a picture of operating conditions beside giving actual cost figures.

Many Questionnaires Sent

Roughly 1700 of these questionnaires were mailed to stone quarry operators throughout the United States in the spring of 1928. Unfortunately we were unable to get them out before the start of the busy production season.

From these, 535 replies were received up to June 1, 1929. These replies were classified as follows:

185 returned completed questionnaire with costs.
78 returned questionnaire without any costs.
141 reported operations idle or abandoned.
71 reported they could not compute costs on the basis requested in the inquiry.
60 refused to co-operate.
1165 made no reply.

While the completed replies represented a little less than 11% of the inquiries, the estimated annual production represented by them by over 35,000,000 tons, or roughly 37% of the crushed stone production in 1927, or 20% of the entire stone production exclusive of dimension or building stone.

A preliminary report consisting of cost tables prepared from replies received from limestone quarries up to November 1, 1928, was prepared and published in February, 1929, as "Report of Investigations, No. 2911."

Immediately thereafter it became necessary for the writer to delay compilation of further returns owing to pressure of other matters requiring attention. In the near future, however, it is hoped that the final tabular compilations for sandstone, granite, trap, and limestone will be published.

Summary

ONE of the most practical steps taken by the U. S. Bureau of Mines to give aid to the crushed stone quarry industry is an attempt to compile quarry costs. A quite elaborate cost blank was prepared and mailed to all known crushed stone quarry operators. Returns were received from producers representing about 20% of the country's production of commercial crushed stone.

That the average crushed stone producer needs education in cost keeping is amply demonstrated by the returns, as well as the lack of returns. This and all agitation that directs attention to costs is helpful and deserves the co-operation of every legitimate producer. Few producers fear the competition of others who keep honest cost figures and are guided by them. The danger in every industry is from the irresponsible producer who does not know his costs.

The completed replies as received are from representative operations in every state in the Union so that the final tabulations should present a fairly accurate cross section of quarry costs in the United States.

The 78 replies received without costs were mainly from small operators, many of whom frankly stated that they kept no cost records. Others sent in their labor, supplies and overhead costs without segregation as to operating steps.

While the lack of cost figures in such cases is regretted, the information as to the other matters was in many cases extremely valuable in that the man-hour expenditure per ton and labor costs could be computed.

Tonnage produced per man hour, and labor costs per ton can be made the basis of close comparisons when operating conditions are known.

In studying the progress of the investigation as outlined one is led to speculate as to the reasons for lack of reply from two thirds of the plants which were circularized. Apparently, many of the plants that directly refused to supply data as well as a large percentage of those who did not acknowledge receipt of the questionnaire were actuated by a company policy of secrecy regarding private costs. Probably some were unable to reply because they kept no cost accounts and very likely others, although realizing the value of such studies were unable to co-operate because their method of computing costs did not lend itself to the information requested in the questionnaire. This latter group is exemplified by the replies from 71 plants reporting that they could not compute their figures on the questionnaire basis.

Whenever one encounters a group of men engaged or interested in the stone quarrying industry it is safe to say that at some point in the discussion the subject of business conditions will be brought up. When this point is reached nine times out of ten the expressed opinion is unanimous that competition is increasing, that the industry is over developed, and that something should be done about it. As to what that "something" should be, there is seldom complete agreement. Generally the group decides that curtailment of production to market requirements is necessary. Curtailment by whom? Usually the other fellow.

Price and Production Generally Coincide

A study of the relation of production statistics to price ranges, more often will show an increase in production coincident with a decrease in price. This is not always the case, but it occurs so often that one cannot escape the conclusion that there is a definite connection between the two.

A decrease in price of any commodity usually involves a decrease in production costs. If the average producer of crushed stone is asked whether present production costs can be decreased or not, he will very likely answer in the negative. Some may reply that considerable economy may be attained and costs reduced by combining many small units into a large organization with extended buying and selling range, but on the whole the consensus of opinion will be that great reductions are not possible.

It is surprising to find that many large companies do not keep records of the costs of the separate steps of quarry operation. They are content to analyze income and expenditures by bookkeeping methods. Simple bookkeeping is important, of course, and necessary for the operating official to visualize periodically the financial condition of

his business. Even alone, although it does not bring to light intimate details, it does picture conditions of the business as a whole. When production and sales are high and the margin of profit satisfactory, the books will show these items, and business seems good. The regular bookkeeping accounts present a graphic picture of the conditions of the business as a whole and are to be considered as business indicators.

When volume of production, sales or profits fall below a satisfactory minimum the business indicator shows business as not so good, or bad, depending on the extent of the depression. Such bookkeeping methods are warnings, but when their warning has been given their value ends. They seldom point out a way to improve conditions.

Value of Cost Accounting

This is where cost accounting comes to the assistance of the operator. If a company has kept accurate record of the cost of each operating step in its quarry manipulation, many times the reason for decreased profits is indicated at a glance. Simple bookkeeping would have shown that operating costs had increased, to be sure, but what they would not have shown is the exact spot where the increase occurred, and whether or not it was a normal and necessary increase. True, the operator may from his knowledge of what has occurred know the exact origin of the increase, but without records he cannot tell that he is justified in assigning the whole of that added cost to that particular item.

One cannot, of course, assign a decrease in profits to an increase in costs in all cases. Costs may have decreased with profits along with decreased prices. Here again a detailed knowledge of costs comes to the rescue, for when an operator is faced with falling prices he must cut costs; to do this he must know, not only what his costs are, but where he can best proceed to cut them. If he has detailed records, his job is half done.

Cost accounting, therefore, is in reality a means of determining the efficiency of a man's business as a whole or in any detail.

In order that his cost accounting may become an efficiency indicator he must have some standard with which to compare his results.

For instance, let us suppose an operator has been stripping his quarry by steam shovel at a cost of 75 cents per cu. yd. of dirt removed, and that his average dirt haul has been 1000 ft. Upon inquiry he finds his neighbor's stripping cost to have been 60 cents for approximately the same length of haul and under similar conditions. His immediate reaction is to ask himself why his cost is higher than his neighbor's. He has automatically used his neighbor's cost for comparison with his own.

If each operator had before him an average cost of each quarry step which he knew was authentic and obtained from a number of other operations working under similar conditions he would know at a glance where his cost for that particular step stood on the scale of efficiency as rated by his industry as a whole. Comparison with his neighbor would not be necessary, as he would be guided by a much wider field of comparison.

Creation of Average Cost Figures

In order to create average cost figures, however, two things are necessary. The first is the co-operation of the entire industry in filing its costs with a central compiling agency together with the details of conditions under which those costs are obtained; the second is that all operators compute costs in such a manner that they can be easily compared step by step.

The second step does not mean that cost accounting methods shall be identical in each plant, but only that certain fundamental rules shall be followed. Subdivisions under these general rules can be as detailed as the individual operator desires.

For instance, if three general items, such as labor, power and supplies were kept for each quarry step a basis of comparison could be had at once. Overhead expense could be lumped and proportioned to the individual steps as their cost relates to the total. Labor costs could be summed up for all operations and totaled for bookkeeping purposes as could power and supplies. In this way the regular bookkeeping and the cost accounting methods could be made to dovetail.

Probably some operators will desire to make a direct charge for depreciation, depletion, etc., to the step involved; for instance, where separate equipment is used for stripping these items should not be included in general overhead charges and prorated with other steps. This would add a fourth direct charge to each step so affected, but would not be difficult to handle.

The preceding suggestion for standardizing cost forms may or may not appeal to operators. If not, the writer feels that a method of accounting, standard in essentials although variable in details, can be devised by co-operation between individual operators that will be acceptable to all.

It was with the idea of establishing a standard form for setting up cost figures for the guidance of quarry operators that the writer began this study. The necessity for a uniform method of accounting became apparent immediately with the arrival of completed questionnaires.

In a table of average costs compiled from a number of operations the mere fact that the figures presented are averages entails individual figures both above and below those tabulated.

In compiling the limestone tables already published the writer was struck by the wide divergence in maximum and minimum costs for individual steps, even when the total costs were close and operating conditions similar. Where one operator would have a maximum quarry loading cost another would have a maximum transportation or crushing cost and yet their totals would be very close. It is evident that if the man with maximum loading costs could reduce them to those of his competitor enjoying the minimum, and his competitor could reduce his transportation or crushing costs to a like lower level both would benefit and both enjoy larger profits in the face of declining prices.

Standardization of Equipment

Large companies operating a number of quarry units are prone to standardize on equipment for operating steps even though conditions may differ at the quarries. This practice is brought out in the questionnaire replies. Such standardization is probably undertaken to reduce costs and possibly it does. If by this standardization of equipment less efficient units are placed at one quarry, that quarry's costs may be increased in spite of the decrease in company costs as a whole. Possibly that individual's quarry's cost may not be increased but even reduced along with the company's general decrease due to standardization. Without a yardstick, as exemplified by a table of average quarry step costs, the company has no means of knowing whether that individual quarry's costs are as low as the average of others in like operating conditions. Therefore, in spite of the reduction after standardization of equipment, possibly the cost is still above what it would be were the equipment suited to that particular plant and not standard with others.

Another angle in which publication of the results of such a study may be of value is in providing an understandable record of costs for the guidance of the newcomer in the quarry industry.

Many people have entered the stone quarry industry with a false idea of costs. By this is meant the difference between operating and total costs. By years of experience the large operator has learned that his operating costs are only a part of his total costs. His overhead costs in many cases equal or surpass his actual cost of operation. The newcomer, however, having no experience, knows little of what the overhead expense is and many times to his chagrin has based his estimates on the cost of operation only. As a result he fails and no industry benefits by the failure of any individual operator.

With an authentic tabulation of costs before him the newcomer is much better armed to ward off failure and make a success of his venture. Or realizing from such a table that the total costs were higher than his estimates of operating costs, he might prudently decide to invest his money in something else.

The study of costs is vital to any industry and the sooner industry recognizes this fact the sooner will it reach that stability for which it strives.

Investigations at Bureau of Standards Dealing With Cement, Lime, Gypsum and Stone*

THE investigations of the physical properties of cast stone, started during the previous year, have been continued. A total of 60 samples of different composition have been collected.

Cast Stone

There has been no change in the test procedure, although two tests showing the absorbing qualities of the materials were added. In the first test the specimens were dried at 65 deg. C. in dry air, instead of the previous temperatures of 105-110 deg., boiled 5 hours and then redried. In the second test the specimens were dried at 35 deg. C. in a current of dry air, and the rate of absorption determined over a period of 48 hours plus 5 hours under reduced pressure, using 300 deg. oil instead of water as the absorbed liquid.

In the first test the absorptions were all less than when the specimens were dried at 110 deg. C., soaked 48 hours in room temperature in water and then boiled 5 hours. This difference is due largely to the difference in drying.

In the second test it was found that in all but one instance at the end of 48 hours absorption appreciably more water had been absorbed than oil, both absorptions being expressed on an equal weight percentage basis. The total percentage of oil absorbed ranged from 2.4 to 13.4 as compared to 4.1 to 18.2 for water. The pore space in commercial cast stone is of considerable volume and can be occupied by a relatively large amount of free uncombined water.

The ranges of the values obtained of all the tests are as follows:

	Maxim'm	Minim'm
Compressive strength, lb./in.², of 2x2-in. cylinders	10,840	1,500
Modulus of rupture, 1x1-in. bar on 6-in. span	1,720	180
Absorption, 48 hr. in water at 21 deg. C., by wt., per cent	14.3	1.7
Absorption, same as above, followed by 5-hr. boiling, per cent	19.2	3.2
Porosity—percentage by volume	33.8	8.8
Secant modulus of elasticity at 50% compressive load, lb./in.²	3,300,000	1,400,000
Cycles of freezing and thawing to cause failure	650	25
Absorption (after drying at 65 deg. C. in dry air), 5-hr. boiling, per cent	17.2	3.0
Absorption, 48 hr. in oil (as compared to water), per cent	9.3	1.6
Absorption as above plus 5 hr. reduced pressure, per cent	13.4	2.4

Publication—"Physical Properties of Commercial Cast Stone," by John Tucker, Jr., and G. W. Walker; American Concrete Institute *Proceedings*, Vol. 25, p. 501, 1929.

*Publication approved by the Director of the Bureau of Standards of the U. S. Department of Commerce.

Reaction of Water on High Alumina Cements

An extensive study is being made of the mechanism of the reaction of water on a series of high alumina cements of varying composition. It is hoped that this study may help explain the heats of reaction and other properties of these cements which are also under investigation. During the reaction of water on all of these high alumina cements there are formed metastable mono-calcium aluminate solutions which in turn decompose as the "setting" processes continue. The range of composition of the calcium aluminate solutions during these reactions has been worked out and a partial phase rule diagram of the system lime-alumina-water has been obtained. This study is a continuation of the more recently published article on the "Reaction of Water on the Calcium Aluminates."

Summary

THESE progress reports cover: Cast stone, physical properties including absorption, resistance to freezing and thawing, etc.; reaction of water on high alumina cements; waterproofing agents for concrete; diatomaceous admixtures and methods of judging their qualities; constitution of portland cement, including the role of ferric oxide and magnesia; the cement reference laboratory; durability of bond between mortar and brick under freezing and thawing tests; water absorption of brick in an attempt to classify brick by absorption; compressive strength of brick walls, its relation to the transverse strength of the brick; compressive and transverse strength of brick; strength of gypsum fiber concrete; expansion of gypsum fibered concrete during setting; soundness tests for lime; particle size distribution of hydrated lime; strength of commercial sand-lime brick; resistance of flooring materials; slate investigation — covering physical properties.

Publication—"Reaction of Water on the Calcium Aluminates," by Lansing S. Wells, Bureau of Standards, *Journal of Research*, Vol. 1, No. 6, page 951; December, 1928; Research Paper No. 34.

Waterproofing Agents for Concrete

The number of different waterproofing agents for concrete has increased many fold in the past few years and since it is important that only materials possessing some real merit should be used, the Bureau is making tests to determine their efficiency.

Fifty integral compounds that are sold on the open market have been put under test. These tests are made on specimens of 1:3:6 concrete to which the waterproofing compound has been added. These specimens are made by putting the treated concrete in a galvanized iron cylinder mold 5 in. in diameter. Around the outside of this 5-in. mold an iron ring 7 in. in diameter and 2 in. high is placed and the space between the two molds filled with a 1:2 cement-sand mortar. The inner mold is removed and the specimen given thirty ⅛-in. drops on the flow table. This tends to bond the mortar and concrete so there will be no leakage down the sides of the concrete portion of the specimen. After 7 days' curing in the damp closet these specimens are bolted between two pipe flanges and 20 lb. water pressure applied. The amount of water coming through the specimen in a certain time is recorded and this is used as a measure of the permeability. The test pieces are kept under a constant water pressure of 20 lb./in.² at all times, and readings are being taken at regular intervals for one year. Specimens of concrete of the same character, but without any waterproofing, are tested at the same time, so comparisons can be drawn.

Another type of waterproofing that is used to a great extent is the exterior coating compound. Fifty of these coatings were obtained from the various manufacturers and are now under test. The method of testing these is merely a prolonged absorption test. The coatings were carefully put on 2x4-in. cylinders of 1:2:4 concrete according to the directions furnished by the manufacturer. These coatings were allowed to dry in the air of the laboratory until the specimen was of constant weight. They were then totally immersed in water. Each cylinder is taken out of the water, the excess of water removed from the surface and weighed at the end of 15 minutes, 1 hour, 2 hours, 4 hours, 24 hours, 1 week, etc. These weighings will continue at weekly intervals for a year.

Study of Diatomaceous Silicas as Admixtures in Concrete

At the request of the Federal Specifications Board a study of diatomaceous silica as admixture in concrete has been made with the purpose of preparing a federal specification for this material.

Thirteen samples were secured from different sources, the material varying greatly

in properties. The maximum and minimum values found are as follows:

	Maximum	Minimum
Weight, lb./ft.^{3}	34.7	7.5
Fineness, percent., through No. 200 sieve	99	86
Loss on drying at 110 deg. C.	5.7	3.1
Loss on ignition, 1800 deg. C.	19.0	2.2
SiO_2	94.8	57.3
Fe_2O_3	3.7	0.5
Al_2O_3	9.8	1.0
CaO	18.4	0
MgO	1.2	0
Settling, remaining in solution at 20 min.	60.4	21.0
5 hr.	25.3	4.3

During the setting of portland cement the water used in the mixture soon becomes saturated with calcium hydroxide. A study was undertaken, therefore, of the reaction of calcium hydroxide with representative samples of diatomaceous silica with the hope that such an investigation would aid in the development of the specifications for the diatomaceous silicas used as admixtures.

It was noted that the diatomaceous silica swells when placed in lime water. A study of the volume of the resulting floc from the various representative samples appears to be an index of the fineness of subdivision and purity of the diatomaceous silica.

It has also been observed that diatomaceous silica will reduce the concentration of lime in a calcium hydroxide solution from 1.15 g. CaO per liter (the approximate concentration of a saturated solution at 30 deg. C.) to about 0.07 g. CaO per liter. Increasing amounts of silica apparently do not further decrease this latter value. This indicates that 0.07 g. CaO per liter represents a point of equilibrium. Some further studies have indicated that a monocalcium silicate hydrate may be formed at this point of equilibrium.

A study of the rate of reaction of calcium hydroxide with silica has shown that different kinds of silicious materials decrease the concentration of the calcium hydroxide at different rates. The rate of the reaction has been measured by both chemical analyses of the resulting solutions and pH determinations with very good agreement. By this method it has been found possible to distinguish the purer grades of diatomaceous silicas (as determined from petrographic examination) from those containing considerable impurities. It has not been found possible to differentiate the purer grades, since the rate of decrease of concentration of the calcium hydroxide is so nearly the same for these latter materials. The time involved in obtaining these rates is too long to be of any value as a method for specifications.

The volume of floc obtained varies from 5 to 33.5 ml. It was noticed that a relationship existed between the volume of floc obtained and the weight per cubic foot of the material.

Two brands of cement were selected, differing considerably in strength properties, and concretes in the proportions of 1:2:4 and 1:2½:5 were made, each kind of diatomaceous silica being used in turn as admixture. In the 1:2:4 mix 3% of diatomaceous silica by weight of cement was used, and in the 1:2½:5 mix 6% was used. The concrete was made into 6x12-in. cylinders, 3 cylinders each tested at 7 and 28 days. The water content for the concretes containing the several admixtures was adjusted to give a flow measurement of approximately 80, using fifteen ⅛-in. drops.

The following summarized results were obtained from these tests:

1:2½:5 mix	Cement	No Admixture	With Admixture Max.	With Admixture Min.
7-day strength lb./in.^{2}	A	630	600	480
	B	860	950	740
28-day strength lb./in.^{2}	A	1480	1440	1180
	B	1850	1830	1480

1:2:4 mix	Cement	No Admixture	With Admixture Max.	With Admixture Min.
7-day strength lb./in.^{2}	A	980	1010	780
	B	1490	1440	1180
28-day strength lb./in.^{2}	A	2330	2250	1920
	B	2860	2760	2200

Yield determinations:

	1:2:4 Mix Bags Cement per cu. yd. Concrete	1:2½:5 Mix Bags Cement per cu. yd. Concrete
No admixture	5.09	4.26
Maximum yield	4.94	4.08
Minimum yield	5.04	4.18

As a result of the work the following requirements are being studied for use in specifications:

1. The loss on drying at 105-110 deg. C. to constant weight shall not exceed 7%.

2. The loss on ignition at 950-1000 deg. C. shall not be more than 15%.

3. The silica (SiO_2) content of the material dried at 105-110 deg. C. to constant weight shall be not less than 80%.

4. The residue on a No. 200 sieve of the material dried at 105-110 deg. C. shall not exceed 10% of the weight of the dry material.

5. Either the weight of the material dried at 105-110 deg. C. shall be not more than 15 lb./ft.^{3}, or the volume of floc in 100 ml. of a saturated $Ca(OH)_2$ solution shall be more than 35 ml.

Constitution of Portland Cement

During the past year several studies of major importance have been under way. An investigation of the reactions of setting and hardening of portland cement has shown the behavior of each of the more important compounds of the cement when allowed to set and harden in the presence of an amount of water sufficient to give a plastic paste. Tests indicate that only the tricalcium silicate and dicalcium silicate function to produce high compressive strengths, and that only the former functions to produce high early strength. A structural theory has been suggested to account for the influence of alumina as the latter affects the properties of the silicates. The development of strength appears to follow closely the rate of hydration of the two calcium silicates.

A study of the role of ferric oxide and magnesia in cement has shown that the substitution of ferric oxide for a portion of the alumina raises the tricalcium silicate content and so raises the strength at early periods. The substitution of magnesia for a part of the lime decreases the tricalcium silicate content and so lowers the early strength. A fluxing action results in both cases which tends to lower the temperature of complete combination, but the increase in tricalcium silicate content when ferric oxide is introduced may, in compositions high in lime, make combination more difficult.

An investigation of the influence of systematically varying composition on the resistance of the cements to the corrosive action of alkali waters has shown that the chief cause of chemical disintegration is the action of sulfates on the alumina compounds in the cements. This is shown to be due to the formation of calcium sulfoaluminate and the resulting large increase in volume. Magnesia solutions are less harmful but attack all compositions.

Investigations have been completed also on the cause of unsoundness in portland cement and on the calcium sulfoaluminates, and a method has been perfected for the calculation of the compounds in a cement from the chemical analysis.

An experimental rotary kiln has been built with which a study is being made of the influence of size distribution of the raw feed on the burnability of the material and strength of the product.

The systems containing the alkalies are now being examined by the methods of phase equilibria.

A study is under way on the influence of composition on the volume constancy of mortars stored under controlled conditions.

Publications—"The Sulphoaluminates of Calcium," by Wm. Lerch, F. W. Ashton and R. H. Bogue; Bureau of Standards Journal of Research, Vol. 2, No. 4, page 715, April, 1929; Research Paper No. 54.

"The Cause of Unsoundness in Portland Cement," by William Lerch; Cement Mill Edition of *Concrete*, Vol. 35, Nos. 1 and 2, July, 1929, pages 109-111, August, 1929, pages 115-118.

"The Calculation of the Compounds in Portland Cement," by R. H. Bogue; *Industrial and Engineering Chemistry*, Analytical Edition, Vol. 1, No. 4, page 192; October 15, 1929.

Cement Reference Laboratory

The Cement Reference Laboratory was recently established at the Bureau under the sponsorship of Committee C-1 on Ce-

ment of the American Society for Testing Materials, for the purpose of promoting improvement and uniformity in the methods of testing cement. The work thus far has been largely of a preliminary nature, although the actual field inspection of cement testing equipment and methods has been commenced.

As a basis for standardization of equipment, tolerances were selected as appropriate for the apparatus and methods involved, and these tolerances have been proposed by Committee C-1 as a tentative amendment to the standard specifications for cement of the American Sociey for Testing Materials. Equipment has been purchased with which to examine apparatus for compliance with these tolerances, and most of the personnel has been secured.

Even this preliminary work has been of value, since it has called the attention of this laboratory to many points of interest in a later consideration of the variables affecting the tests, and in planning improvements in apparatus or methods. The consideration of tolerances alone brought out the fact that some of the apparatus was of a type not heretofore covered by any definite specifications, and that but little study had been made of the question of appropriate requirements.

The few inspections already made in the field have been productive of interesting data, not only as to apparatus, but particularly as to methods, conditions and questions of differences in applying specifications. Since the work is purely co-operative, with no compulsory or confiscatory features, it seems that the laboratories may be expected to continue their present attitude of friendly and interested participation in studying conditions and questions.

The local laboratory work of instruction has not been started, and this, together with comparative tests carried out with other laboratories, will be deferred until improvements in equipment are completed and a larger amount of data secured from the field.

Durability of Bond Between Mortar and Brick

During the year some progress has been made on an investigation of the strength and durability of the bond between mortar and brick. A total of 864 test specimens were made, each consisting of two bricks bonded together by a bed of mortar. The bricks used consisted of samples from four manufacturers and those from any one source differed markedly in absorption properties from the others. But one mortar mixture (composed of one volume of portland cement, one volume of hydrated lime and six volumes of sand) was used for all specimens. In some of the specimens were placed metal lugs which tended to prevent the drawing together of the bricks as might otherwise take place due to a shrinkage of the mortar. Some of the bricks were set dry, others 50% saturated, and the rest saturated.

The specimens were subjected to one of the following conditions during two months' aging: Exposed outdoors, stored at normal room temperature and humidity, or in an atmosphere maintained at about 70 deg. F. and a relative humidity higher than 95%. After this aging period one-half of the specimens were subjected to 50 cycles of freezing and thawing, the specimens being frozen while partially immersed and thawed by complete immersion in water. The others remained in storage for six months when they, together with the survivors of the freezing and thawing cycles, were tested to determine the tensile strength of the bond.

It is indicated that both durability and strength of bond are practically independent of any property of the brick, though more data are needed to prove this point. Bonds obtained with highly impervious brick of extremely low absorption were about as strong and equally as durable as those obtained with highly porous bricks. The degree of roughness of the bonded surface of the brick seemed to be an important factor.

Less than 10% of all of 432 bonded units survived 50 cycles of alternate freezing and thawing. Among those which survived the bonds were not weakened, but in many cases were stronger than the bonds of twin units remaining for six months in storage. Failure of bond was not due to disintegration of either brick or mortar. It is indicated that failure was due generally either to the forces set up by frost action or by volume differentials existing between brick and mortar. These are produced by an apparent initial shrinkage on the part of the mortar, followed by a subsequent expansion during the consecutive freezing and thawing cycles which are attended by a continual increase in degree of saturation.

Freezing and thawing tests were made with individual bricks (not in contact with mortar). It is indicated that 100 cycles of such do not appreciably lower either the dry weight or the transverse and compressive strengths of the marketable face brick that are being studied.

Water Absorption of Brick

Two independent investigations of the absorption of clay brick have been made, both being parts of more comprehensive studies of the factors affecting the service characteristics of brick masonry. In one, bricks from 10 different manufacturers were tested to determine their rates of absorption during partial immersion and their absorptions when totally immersed in water at 20 deg. C., and after immersion in boiling water for 7 hours. For the partial immersion tests, the bricks were immersed to a depth of ⅛ in., some of the specimens being set on end, others on edge, and the rest flatwise. The rates of absorption were determined by weighing the bricks at definite time intervals and by noting the time required for moisture to travel through and reach the upper surfaces of the specimens. For the total immersion tests at normal temperatures, the specimens were completely immersed until the gain in weight became less than one gram per 24 hours, this requiring periods ranging from 48 to 96 hours.

In the other investigation bricks from 26 different manufacturers were subjected to absorption and penetrability tests. Some manufacturers submitted specimens which were considered by them to be underburned, in addition to those representative of their normal product. Others submitted three classes giving a still wider range in the firing treatment. Partial immersion tests were made by the method previously described except that the maximum period was limited to one hour. Absorptions by total immersion in water at normal room temperature were determined for periods ranging from one to 48 hours, after which the specimens were boiled for 5 hours.

The following are the principal conclusions resulting from the investigations:

1. For any one make of brick the absorptions of specimens, totally immersed in water at room temperature for periods ranging from 48 to 96 hours, were approximately proportional to the three-halves power of the absorptions by 7-hour boiling.

2. When the wetting through of the bricks was completed during one hour of partial immersion, the absorption was in close agreement with the absorption determined by total immersion for the same length of time.

3. The ratio for absorption by 5-hour cold total immersion to that by 48-hour cold total immersion ranged from 0.61 to 0.98.

4. For any one make of brick, the ratio between the absorption by 48-hour cold total immersion to that by 5-hour boiling was higher for the specimen designated by the manufacturer as underburned than for the rest.

5. These ratios were found to be inadequate for classifying bricks from several sources, the values for the underburned specimens from one source being lower, in many cases, than for the well burned specimens from other sources.

Publications—"Some Absorption Properties of Clay Bricks," by L. A. Palmer; Bureau of Standards Journal of Research, Vol. 3, No. 1, page 105, July, 1929; Research Paper No. 88.

"The Water Absorption and Penetrability of Brick," by J. W. McBurney; Proceedings of the American Society for Testing Materials, Vol. 29, Part II, 1929.

Compressive Strength of Brick Walls

One of the conclusions drawn from a rather extensive investigation of the compressive investigation of the compressive strength of brick walls, carried out during

the years 1927 and 1928, was that the compressive strength of the brick gave a better indication of wall strength than the transverse strength of the brick. The generality of this conclusion was questioned because none of the walls tested had been built with brick having an unusually low transverse strength in comparison with the compressive strength. During the past year additional data have been obtained by the construction and testing of five walls each 9 ft. high and 6 ft. long and seven wallettes (small walls) each approximately 3 ft. high and 18 in. long. The later tests were planned to give further information on the strengths of walls built with bricks which were either uncommonly weak or strong, or weak transversely in comparison to the compressive strength.

The walls were constructed in the laboratory by the two masons who built the specimens for the previous investigation. The chief difference between the walls built by the two masons was in the filling of the mortar joints. The horizontal bed joints prepared by mason A were furrowed and did not afford a full bearing for the bricks, while those prepared by mason B were smooth spread and gave full bearing. Mason B also filled completely the vertical joints in the faces of the walls.

The results of the tests indicated that the strength of the masonry was more closely related to the compressive than to the transverse strength of the brick. It was found that, where mortar and workmanship were the same, the strength of the walls was roughly proportional to the compressive strength flatwise of the brick. The proportionality did not hold over the extreme range in values, the ratio of masonry strength to brick strength being greater in the case of the weaker brick.

Compressive and Transverse Strength of Brick

Bricks from 27 different manufacturers were subjected to the usual forms of compressive and transverse tests, the compressive tests being made both edgewise and flatwise. The ratios between any two of the strength measures were found to be fairly constant with brick from the same plant but to differ widely in the case of those from different manufacturers. An attempt was made to determine the causes of these variations by comparing the strength values with the laminar structure of the bricks. Data on the methods of manufacture were obtained and were correlated with ratios between the different strength measures of the bricks.

The ratio of the compressive strength of brick tested flatwise to the compressive strength edgewise ranged from 0.74 to 2.3, while the ratio between modulus of rupture and compressive strength flatwise ranged from 0.426 to 0.070. Such wide ranges in the values for these ratios show that there is not a close linear relationship between the strength measures. Neither was there found a close relationship non-linear in form. In view of this it may be concluded that, for brick from different sources, one of the measures of strength is not a close measure of the others.

The deviations of the ratios between the different measures of strength appear to be due, at least in part, to the laminar structure of some bricks and to differences in the amount, direction and effect of the pressure on the bricks while being fired. Usually the compressive strength edgewise was greater than the compressive strength flatwise of brick molded by the soft mud process, while the reverse was true for brick molded by different process; though there were several exceptions in both cases. Ratios of modulus of rupture to compressive strength tended to be lower for laminated side-cut brick and were invariably higher for laminated end-cut brick than for those molded by other processes.

Publications — "The Compressive and Transverse Strength of Brick," by J. W. McBurney; Bureau of Standards Journal of Research, Vol. 2, No. 4, page 821; April, 1929; Research Paper No. 59.

Strength of Gypsum Fiber Concrete

Gypsum fiber concrete is a concrete which contains calcined gypsum as the cementitious material and a light material, usually planer shavings, as the aggregate. It is used for poured-in-place floors and roofs, where its lightness, quick set and fireproofing qualities are desirable. In cooperation with the Gypsum Institute, the Bureau of Standards has been developing the data necessary for computing the allowable working stresses on the concrete. Two types of calcined gypsum, representing the extremes of quality commercially obtainable, were used in the investigation. The wood chip content of the concrete was varied from 0 to 12½%. The amount of mixing water was varied over the ranges which would be usual in commercial practice.

The results indicated that gypsum fiber concrete with 3% of chips, when dried to constant weight in a gas fired oven at 100 deg. F., had a compressive strength of from 800 to 1300 lb./in.^{2}. With 12½% chips, dried under similar conditions, the compressive strength was from 450 to 600 lb./in.^{2}. Specimens tested after storage for three months at 70 deg. F. and 80% relative humidity showed strengths averaging 77% of similar oven-dried specimens. The modulus of rupture of 3% chip mixes, oven-dried as above, was from 210 to 320 lb./in.^{2}; of 12½% mixes was from 110 to 170 lb./in.^{2}. The modulus of elasticity of 3% chip mixes, oven-dried, was from 580,000 to 850,000 lb./in.^{2}; 12½% mixes was from 200,000 to 300,000 lb./in.^{2}.

Expansion of Gypsum Fibered Concrete During Setting

As part of the program for determining the volumetric changes which gypsum fiber concrete undergoes, both during and after setting, the expansion during setting has been measured. Five types of calcined gypsum have been used in this investigation, rotary calcined stucco, gaging plaster, tube milled stucco, kettle calcined gypsum and precipitated gypsum. Each of these has been mixed with various amounts of commercial wood chips and water, and the expansion during setting has been measured. The expansion varied from 0.08 to 0.30%. Using neat mixes of standard testing consistency, the precipitated gypsum expanded least, the rotary calcined gypsum expanded most, while the others were intermediate. In all cases, increases in the amount of mixing water decreased the expansion for a given mix. Holding the amount of mixing water constant, and replacing part of the plaster by an equal weight of chips increased the expansion during setting.

Soundness Tests for Lime

The soundness of lime is one of the important properties of the material, determining as it does whether the plaster will pop or pit when applied to the wall. The present laboratory method for determining soundness of lime, adopted as standard by the Federal Specifications Board and by the American Society for Testing Materials, requires three days for completion of the test. Because of the amount of time consumed in the test the method is undesirable. The bureau has been investigating other methods for determining soundness of lime in order to shorten the testing period. A method which gives promising results consists of making a putty of the lime to be tested, adding to this putty some calcined gypsum and then spreading the putty on a porous porcelain plate. When the gypsum has set, the plate is placed in an autoclave and steamed under pressure for about three hours. Unsoundness is evidenced by popping or pitting of the plaster on the plate. The results of the tests are being checked by panel tests, panels 12x15 in. are made, and the lime being tested is used in the finish coat. The panels are allowed to age in the laboratory air and are examined monthly for defects. The results obtained thus far indicate that steaming for three hours in the autoclave at 125 lb. pressure more closely represents the results obtained on a six months' exposure of the panels than does any other method for determining unsoundness which has been tried in this investigation.

Particle Size Distribution of Hydrated Lime

The distribution of particle sizes in hydrated lime has, in the past, received little attention. This is unfortunate, inasmuch as the size of the lime particles probably con-

trols, to a large extent, the other properties of the lime. The bureau, in an attempt to determine the particle size, has constructed a sedimentation apparatus which is capable of giving the desired results. A few preliminary experiments have shown that hydrated lime consists of a mixture of particles from 74 micron diameter (No. 200 sieve) down to 1 micron or less. The size distribution curves thus far obtained show a fairly uniform distribution, all sizes between 74 and 20 micron appearing in about equal proportions. In the region between 20 and 1 micron a decided maximum occurs in the distribution curve, indicating that the majority of particles are found within a narrow size range. The maximum occurs at different particle size for different limes, indicating that it may be a characteristic of the lime. The investigation is being made to determine the relations which exist between the particle size distribution and the other properties of the lime.

Strength of Commercial Sand-Lime Brick

Sand-lime brick are used to an appreciable extent for construction in various localities. As the factor of main importance in masonry construction is strength, it is desirable to know what strength may be expected from the commercial brick. Lots of 40 brick each were obtained from 27 different manufacturers. The absorption, transverse strength, compressive strength flat and compressive strength on edge were determined on each brick. The absorption (averages for 40 brick) on five hours, cold, total immersion ranged from 8.3 to 15.5%; on five hour boil, from 13.3 to 21.6%. The modulus of rupture ranged from 334 to 930 lb./in.^{2} and the compressive strength flat ranged from 2150 to 5500 lb./in.^{2}. Five manufacturers produced brick with a modulus of rupture of less than 450 lb./in.^{2}, 10 produced brick with a modulus between 450 and 600 lb./in.^{2} and 12 produced brick with a modulus of over 600 lb./in.^{2}. The results showed that practically no relation existed between the various strengths of individual brick, even when only those of one manufacturer were considered. Considering the averages obtained for each make, however, fairly definite relations were obtained. An additional 10 brick from each manufacturer were obtained. The absorption characteristics of each brick have been determined. These brick are to be subjected to freezing and thawing as an accelerated weathering test.

Publications—"Absorption and Strength of Commercial Sand-Lime Brick," by H. F. McMurdie; Rock Products, Vol. XXXII, No. 24, November 23, 1929.

Wear Resistance of Flooring Materials

The apparatus designed and constructed at the bureau for measuring the comparative wearing qualities of flooring materials has been the subject of further study and a few minor improvements have been made. Attention has been centered chiefly on the effect of humidity on rate of wear, with a view to arriving at a correction factor which could be applied to results obtained under various humidities, rather than on the control of humidity. The results indicate that a large majority of materials abrade considerably faster on days of high humidity, but unfortunately there are exceptions to this as shown below:

HARDNESS VALUES (Ha) OBTAINED UNDER VARIOUS HUMIDITY CONDITIONS

	Ha values at humidity (R.H.) indicated			
Material No.	R.H. =36	R.H. =46	R.H. =56	R.H. =74
923	7.7	7.0	6.6	5.9
844	11.4	10.8	10.5	10.6
615	21.0	19.3	18.0	16.0
586	3.6	3.2	3.0	3.0
750	4.6	4.5	4.8	5.0
686	.....	5.2	5.1	4.1

These results indicate higher abrasive rates and hence lower hardness values for higher humidities except for one material out of six which indicates the opposite. They also indicate that a different humidity correction would have to be obtained for each material, which would not be feasible. It was, therefore, decided to make all tests on days of low humidity, i. e., when the relative humidity was between 25 and 35%, rather than to put the apparatus in a room under controlled conditions. Although this procedure requires waiting for suitable weather conditions, it is believed to be more practical for other laboratories that might wish to make tests for comparison of materials with results already available.

A considerable number of natural materials have been tested under humidity conditions varying between 25 and 35% and a summary of these results follows.

	Hardness values (Ha) Highest	Lowest	Average
Marble (142 tests)	34.5	7.5	17.0
Serpentine (14 tests)	97.6	12.9	42.3
Limestone (149 tests)	24.9	1.0	9.8
Sandstone (12 tests)	10.8	2.5	6.7
Granite (30 tests)	75.1	37.0	56.3
Slate	15.2	5.8	8.1

The Ha values given above were determined by abrading the various materials with No. 60 artificial corundum when held on a grinding lap and each specimen weighted with a 2-kilogram load. The values are computed as a reciprocal of the volume abraded in a given time, hence the higher Ha values indicate materials of higher wear resistance.

Slate Investigation

The research concerned with the physical properties of slate has embraced studies on 60 samples from Maine, Vermont, New York, Pennsylvania, Maryland, Virginia, Georgia, Tennessee, and Arkansas. Approximately 3000 tests have been completed which indicate the following values given below:

	Highest	Lowest	Average
Modulus of rupture lb./in.^{2}	16,160	3,380	9.340
Modulus of elasticity	18,400,000	7,400,000	13,400,000
Toughness (maximum deflection for 15.5 in. span and 3/16. in. thickness)	0.240	0.081	0.145
Abrasive hardness (Ha)	15.2	6.2	8.3
Absorption (percent. by wt.)	1.63	0.10	0.27
True specific gravity	2.90	2.77	2.78
Bulk specific gravity	2.87	2.74	2.76

Weathering tests have consisted of determininations of effects of frost action and the action of dilute acids. Some of the samples have been subjected to more than 4000 freezings in a water-soaked condition and the results indicate that frost action on this material takes only a minor part in the weathering process. The deterioration caused by the acid condition of rain water is probably of more importance and attempts to stimulate this effect have been made by immersing specimens in a 1% solution of sulphuric acid for 20 days, after which strength determinations were made. The results of such tests indicate that some slates are quite appreciably attacked by acids which is manifested by color changes and softening for a small depth below the surface. The color changes appear to bear no relation to color changes which occur when slate is exposed to the weather, and there is considerable doubt as to whether such tests cause the same type of decay as that from actual exposure to the weather. In order to obtain more information as to what happens in the weathering of roofing slate a comprehensive study of slate shingles which have been in service for a long period of time has been undertaken. The cooperation of a large number of slate producers has been secured, and old buildings in various parts of the country are being sampled. It is hoped that the study of these samples by microscopic and chemical means as well as physical tests will lead to a better understanding of the weathering processes and enable the laboratory to establish a satisfactory basis of determining weathering qualities.

Stone Company Bankrupt

LISTING liabilities at $26,421.70 and assets totaling $102,555.76, the Ohio Lime and Stone Co., Pemberville, Ohio, filed a petition in voluntary bankruptcy in federal court recently. The petition is signed by C. C. Greiner, president. Of the claims, $3,265.40 are listed as unsecured. Real estate is valued at $100,673.22. Of the liabilities, $21,099.92 comprise unpaid bills due various firms for supplies and materials.—*Toledo* (Ohio) *Blade.*

Work of the Bureau of Mines on Nonmetallic Minerals During 1929

By Oliver Bowles

THE BUREAU OF MINES work on nonmetallic minerals is of two kinds, economic and technologic. The economic studies are centered in the Washington office and the technologic chiefly at the experiment stations.

Economic Studies

Materials of Construction—Economic studies of nonmetallic minerals are conducted by the rare metals and nonmetals division. The chief activities of the building materials section of this division have to do with the great group of mineral commodities used for the most part in the construction industries. Sand and gravel, crushed stone, building stone, lime, cement, gypsum and asbestos constitute the chief commodities in this group. The greatest of them all on a tonnage basis is sand and gravel, production for 1928 exceeding 200,000,000 tons. Expansion in this industry has been rapid. As surface deposits are numerous there is a tendency toward opening up new deposits, many of such enterprises being ill advised and doomed to failure from the start. To prevent as far as possible such unwise ventures the bureau has issued Economic Paper 7, entitled "Economics of New Sand and Gravel Developments," by J. R. Thoenen, the chief purpose of which is to cover in some detail all the factors that should be carefully considered before a new deposit is opened up.

The first phase of the cost study of the stone industry begun in 1928 was completed during 1929. Cost figures were submitted to the bureau by many companies and from these returns a report was compiled, entitled "Study of Quarry Costs," Serial No. 2911, by J. R. Thoenen. This report summarized various aspects of limestone quarry costs. A report covering costs in quarrying other types of rock is now in progress.

A cost study of the slate industry was also undertaken, but the returns were so incomplete that the problem was changed to embrace the establishment of a standard system of accounts for the slate industry. Such a plan has been drawn up and published under the title, "A System of Accounts of the Slate Industry," Serial No. 2971, by Oliver Bowles.

A continuing problem of the building materials section is a study of trends and tendencies in the industries producing the raw materials of construction. The substitution of one type of material for another, such as cement for building stone or paving blocks, gravel in place of crushed stone, or mineral wool in place of asbestos, may lead to increases or decreases in demand having an important bearing on the future of these industries. Changes in regional demand also have a bearing on marketing centers and on transportation. Changes in modes of transportation are also demanding study. The growing tendency toward water transportation of crushed stone, cement and gypsum is significant.

Mica—The rare metals and miscellaneous section has also conducted a series of economic studies of various nonmetallic minerals. F. W. Horton is completing an economic survey of the mica industry in cooperation with the War Department. The main object is to determine to what extent the United States could supply her needs of mica in case of an emergency. Much interesting data is being compiled both on the properties of mica and the extent of domestic deposits. Both di-electric and high temperature tests demonstrate that American mica is as good as any in the world. In addition to this special study, W. M. Myers has prepared an information circular covering much general data on this subject. The report is entitled, "Mica, Part I, General Information," Circular No. 6205. Other mica reports are in preparation.

Summary

THE United States Bureau of Mines is digging into some very practical problems of the rock products industry.

The literature detailing the results of these investigations is reviewed. Any of these reports may be had by interested producers for the asking.

Such reports as that forthcoming on anhydrite should be of interest to all industries which desire to know the fineness of very fine mineral particles.

The investigation aimed at the separation of mica from feldspar by flotation may develop data of practical value to sand producers who must separate mica from fine sand.

Potash—The possibilities of economic recovery of potash from alunite, leucite and wyomingite are being studied by J. R. Thoenen. The factors considered include estimated cost of treatment by various proposed processes and the market requirements, prices and freight rates of potash and by-products.

Miscellaneous Reports—Quite a number of reports have been prepared covering the general aspects of various nonmetallic minerals. R. M. Santmyers has written four reports on gypsum as follows: "Marketing Gypsum Products," Circular No. 6157. "The Canadian Gypsum Industry," Circular No. 6162. "Gypsum, Its Uses and Preparation," Circular No. 6163. "Development of the Gypsum Industry by States," Circular No. 6173. The report on marketing problems is of special interest. R. M. Santmyers wrote a general report on "Ocher and Ochery Earths," Circular No. 6132, also a report on barytes and one on barium products, but they have not yet been published. Paul M. Tyler has prepared a series of comprehensive general reports on graphite as follows: "Graphite, Part I, General Information," Circular No. 6118; "Graphite, Part II, Domestic and Foreign Deposits," Circular No. 6122; "Graphite, Part III, Utilization of Graphite," Circular No. 6123, and "Graphite, Part IV, Status of the American Graphite Industry," Circular No. 6124. He also prepared a general report on "Clay," Circular No. 6155. Alice V. Petar has written a report on "Beryl and Beryllium," and also a report on "Andalusite, Sillimanite, Cyanite and Dumortierite." The latter group of minerals is attaining considerable importance in the manufacture of electric porcelain. B. L. Johnson is preparing a general report of phosphate rock and several special reports covering certain economic aspects of the industry.

Mineral Recources Reports—An important phase of the economic work of the bureau is the preparation each year of a series of pamphlets covering production, stocks, imports, exports and various other statistical features of about 30 nonmetallic minerals. These reports also contain much information of a general character such as uses, distribution, lists of producers and consumers, and items of interest on new technical or economic developments. Each chapter is issued as a "separate" and later the chapters are combined in bound volumes, entitled "Mineral Resources of the United States." They are compiled by the division of mineral statistics under the direction of F. J. Katz, though a background of general data and significant features is supplied by members of the staff of the rare metals and nonmetals division.

Technologic Studies

Potash—One of the most important laboratory studies now under way is a de-

termination of the best method of recovery of potash from its ores. The work to date has dealt mainly with the treatment of polyhalite found in the drill cores from Texas and New Mexico. A process has been devised which permits the recovery of potash at quite low cost, certain details of which are given in a Report of Investigations of the Bureau of Mines. This work is being done at the Nonmetallic Minerals Experiment Station at New Brunswick, N. J., under the direction of H. H. Storch. Equipment of sufficient size has been provided, under the Winter Bill, to conduct semi-commercial tests. Chemical work on the recovery of potash from greensand, alunite, wyomingite and other potash-bearing minerals has just been started.

The five-year drilling program under the supervision of the Bureau of Mines is still in progress. The results of government drilling together with drilling by private companies has demonstrated that large reserves of potash-bearing minerals of commerial grade are available in Texas and New Mexico.

A very complete bibliography of all foreign literature on potash has been prepared by J. F. T. Berliner but has not yet been published. A bibliography on greensand by R. Norris Shreve has also been completed.

Anhydrite—The New Brunswick experiment station is continuing the study of anhydrite as a cement retarder. The effect of extreme fineness of the anhydrite is to be tested, and a new type of air analyzer has been developed whereby extremely fine-grained material may be uniformly classified by size. This is described in a Bureau of Mines Technical Paper now in press.

The Wire Saw in Slate—Considerable attention is still being given to the use of the wire saw in slate which was recorded as an active problem last year. A report of progress, entitled "The Wire Saw in Slate Quarrying, Second Supplementary Report," Serial No. 2918, by Oliver Bowles, was issued in March, 1929, and a printed, illustrated report covering the problem is now in press. Over 30 wire saws are now in use by about 20 companies in Pennsylvania and New Jersey. In addition to a great reduction in the enormous waste which is characteristic of the industry it is estimated that this new type of equipment is saving the Pennsylvania industry about a quarter of a million dollars a year in reduced operating expense.

The Wire Saw in Other Rocks—The remarkable success of the wire saw in slate has encouraged its use in other branches of the building stone industry, and the bureau has supplied a great deal of information to prospective users. Several marble companies have tried it. Some are finding it successful, while others have failed to obtain a sufficient cutting speed to justify its use. One producer of a very hard sandstone tried it without success. Both granite and limestone producers are giving it serious thought.

Part of the extensive data files maintained in the building materials section

Ochers and Mineral Pigments—Under the direction of Prof. Hewitt Wilson a detailed study of ochers and mineral pigments is being conducted at the Northwest Experiment Station at Seattle, Wash. The first phase of the work was confined to the natural pigments of the Northwestern States and a report covering this work has been published as Bureau of Mines Bulletin 304, entitled "Ochers and Mineral Pigments of the Pacific Northwest." So much information of interest was compiled and the technique, particularly in color determination, attained such a degree of perfection that it seemed desirable to extend the study to other ochers. During the past year, therefore, correspondence has been conducted with many state geological surveys and as a result samples have been submitted from about 20 states. Professor Wilson is now conducting a study of these samples for a comprehensive report on the "Ochers and Mineral Pigments of the United States." Aside from the steady production of several plants at Cartersville, Ga., and some recent activity near Hickory Flat, Miss., the ocher industry of America has been of small importance, and it is believed that the detailed study now being made will encourage the development of a more active industry.

Purification and Treatment of Clay—The Northwest Experiment Station is continuing its study of methods of dewatering clay suspensions. The electrophoresis method used in conjunction with electrolytes is effective, but its commercial possibilities have not yet been determined. A study is also being made of methods of bleaching clays to remove staining materials.

Concentration of Phosphate Ores—The impurities in pebble-phosphate are removed by a simple screening and washing process. The fine materials discarded are often rich in phosphate and the Bureau of Mines has been conducting a study at the Southern Experiment Station, Tuscaloosa, Ala., to devise means of concentrating such material so that it may be utilized. Report No. 2925, "Losses of Phosphate in the Land-Pebble District of Florida," by H. M. Lawrence, indicates that rejects from the washers fall into two classes: (1) Fine materials below 16-mesh which constitute the greater part of the rejects, and (2) coarser material between 16- and 20-mesh. It was pointed out that a considerable part of this coarser material could be recovered by using washers, screens and classifiers. Recovery of the fine-grained phosphate is more difficult. Flotation methods as applied to this material were studied in some detail and the results published in Report No. 2860, entitled "Flotation of Low Grade Phosphate Ores," by H. M. Lawrence and F. D. DeVaney. It was demonstrated that the finer sizes of phosphate rock can be beneficiated by flotation, but the method cannot be applied directly to commercial practice without further research.

Bauxite—The work of the Southern Experiment Station on the benefication of low grade bauxite has been completed and the results published as Bureau of Mines Bulletin 312, "Bauxite: Float and Sink Fractionations and Flotation Experiments," by B. W. Gandrud and F. D. DeVaney.

Mica and Feldspar—The Intermountain Experiment Station of the bureau at Salt Lake City, Utah, has recently undertaken a study of the separation of mica and feldspar by flotation. The successful application of flotation to nonmetallics is one of the outstanding developments of recent years.

Service Work—In addition to the numerous special problems discussed above the bureau specialists are constantly called upon to supply answers to a multitude of questions propounded by visitors, through telephone calls or as correspondence. Very extensive data files have been built up to provide reliable information so that the bureau may be of real service to all inquirers.

Investigations in the Field of Rock Products Conducted by the Bureau of Public Roads During 1929

By F. H. Jackson
Senior Engineer of Tests, U. S. Bureau of Public Roads, Washington, D. C.

DURING the past year the United States Bureau of Public Roads has carried on a number of investigations of interest to both the producer and the consumer of mineral aggregates used in road construction. These researches have been for the most part in connection with the use of aggregates in portland cement concrete, although some laboratory and field work having to do with the effect of grading and character of mineral aggregates upon the stability of bituminous mixtures has also been done.

Outstanding among the concrete investigations are, first, a laboratory study of the effect of type and gradation of coarse aggregate upon the strength of concrete, and second, a study of concrete paving mixtures for the purpose of determining the maximum amount of coarse aggregate which may be employed when the uniformity of the grading of the coarse aggregate is carefully controlled by measuring it in three separate sizes. This latter investigation is still in progress.

Effect of Kind and Character of Aggregate

The first of the two research projects referred to above has been completed and has yielded some interesting results. Until quite recently it has been commonly assumed that so long as the mineral aggregates were sound and reasonably hard the particular kind or character of aggregate employed would have little, if any, effect on the strength of the concrete. In this way such proportions as 1:2:4, 1:3:5, etc., indicating proportions by volume of cement, sand and coarse aggregate, respectively, came to be rather generally accepted as indicating concrete of a definite class or quality. However, it is becoming more and more apparent, as the results of additional research become available, that the strength of concrete may be affected appreciably by the kind of coarse aggregate used. It has become evident that if concrete mixtures are to be designed intelligently consideration must be given to factors other than simple volumetric proportions.

The results of the study in which 17 different aggregates differing widely in character were employed showed that, other things being equal, a change in the type or kind of coarse aggregate used in the mixture may cause a very considerable change in the strength of the concrete, in some cases as much as 30%.

To illustrate, one of the aggregates chosen for study, when used in concrete in a 1:1.6:3 mix, gave an average modulus of rupture of 535 lb. per sq. in., while another material in concrete of the same proportions gave an average modulus of 650 lb. per sq. in. In concrete of a 1:2:4½ mix the same materials gave average moduli of 420 and 520 lb. per sq. in., respectively. The significant point of this comparison is the fact that one material in the lean mix (1:2:4½), which required only 5 sacks of cement per cubic yard of concrete, produced concrete of practically the same strength as the concrete of the richer mix (1:1:6:3) containing the other material and requiring 6.6 bags of cement per cubic yard.

On the assumption that it is desired to build a concrete pavement of a certain definite strength, and that these two aggregates are both available and sell at approximately the same price, the use of the aggregate producing the higher strength would result in a saving, under normal price conditions, of at least $1500 per mile of 18-ft. roadway. This example illustrates the economic advantage of a definite knowledge of the factors which affect the quality of concrete and the rational application of this knowledge in the design of concrete mixtures.

Use of Maximum Amounts of Coarse Aggregate

The maximum amount of coarse aggregate which may be used in concrete mixtures without sacrifice of quality is another problem of importance. Other things being equal, the greater the proportion of solid stone or gravel in a unit volume of concrete, the greater is the durability of the product from the standpoint of resistance to weathering action.

On account of the extra labor involved in the hand finishing of concrete containing a high percentage of coarse aggregate, the use in paving work of mixtures containing an excess of mortar has come into general favor even though such mixtures may not be the most economical from the standpoint of the cost of materials and even may be somewhat deficient in quality. The great advances which have been made in the development of mechanical equipment, with the consequent reduction of hand labor, has made practicable the use of the harsher concretes which are produced when appreciable increases are made in the proportion of coarse aggregate. Thus, it becomes necessary to know the effect of increases in the amount of coarse aggregate on that most important quality, strength.

For the purpose of studying this problem an investigation was started last year which involved the construction of an experimental pavement 9 ft. in width and somewhat over a half mile in length. In the test sections of which this pavement is composed various proportions of gravel, crushed stone and blast furnace slag were used. In order that the results obtained may be representative of those which might be secured in regular paving work, the construction work was carried on with mechanical equipment of the latest design, including weighing batcher-plants for proportioning the materials, a full-size paving mixer, and finishing machines. In addition, the coarse aggregates were proportioned in three separate sizes in order to control uniformity of gradation.

The pavement will not be subjected to traffic but will be cut into beams the flexural strength of which will be determined by testing. The investigation included the placing of more than 600 cu. yd. of concrete and about 5000 specimens will be tested.

Looking for Light-Weight Concrete Pavement

In the construction program of the Port of New York Authority there are included a number of long-span bridges, the most notable of which is the Hudson river bridge, which will have a main span of 3500 ft. the longest suspension bridge in the world at this time. Possible improvements in the quality of concrete used in the floor slabs of bridges and possible advantages to be gained by the use of lightweight concrete in the floors of long-span bridges are matters of general importance in the highway field and of great interest to the Port of New York Authority. The common interest in these problems led to a co-operative arrangement between the Bureau of Public Roads and the Port of New York Authority under which an extensive series of tests is being conducted at the Arlington Experiment Farm.

The program involved the construction, with materials and methods such as might be used in the construction of bridge floors, of 22 concrete slabs, each 6 ft. wide and 22 ft. long. Different aggregates have been used, including one of light weight, which resulted in a concrete weighing only about two-thirds as much as the ordinary product, and different vibratory methods were em-

ployed in placing the concrete for the purpose of increasing its density and thereby improving its quality. The large slabs were subsequently cut up into smaller pieces of sizes suitable for testing. The program includes tests to determine the strength of plain and reinforced slabs, the bond strength of embedded steel, and the density, durability, and elastic properties of the concrete. The testing work is approaching completion and it is indicated by the data thus far available that information of considerable value to highway engineers will be obtained.

Studies of Fine Aggregate

Additional studies in aggregates which are being carried out in the laboratory include an investigation of the effect of character of fine aggregate upon the strength of mortar. This study parallels the one which has just been completed on coarse aggregates and involves the testing of over 50 sands from various parts of the country. In this study the effect of grading will be eliminated by regrading all of the sands to the same sieve analysis before testing. The primary object is to determine effect of such factors as shape of grain, surface texture, mineral composition, etc., upon strength.

Soundness of Aggregates

Studies have also been carried out for the purpose of developing further information regarding the variables which affect the sodium sulphate test for soundness of aggregates. It has been shown that, due to the possible introduction of variables which may quite appreciably affect the results, this test must be interpreted with great caution. The Bureau of Public Roads is now developing a revised procedure which should eliminate the effect of some of these factors.

Agricultural Liming Materials in Ohio

By W. H. Margraf

Secretary and Treasurer, National Agstone Association, Columbus, Ohio

YOU will note in this review the term agricultural liming material is used instead of agricultural limestone and includes lime, limestone or carbonate form of lime. The tonnage of liming material sold in Ohio in the year 1928 is as follows:

	Tons
Agricultural limestone, including meal, marl, ground or pulverized limestone or carbonate form of lime	179,975
Hydrated and burnt lime	18,138
Other lime material	12,570
Total	210,683

Information already received leads me to believe that the total tonnage of liming material shipped in 1929 will be close to one quarter of a million tons with a big increase in tonnage of hydrated lime. This increase in hydrated lime traces back to the break in price in hydrated lime and the farmer was quick to take advantage of the price reduction. The tonnage of agricultural limestone meal, ground, pulverized, marl and carbonate form of lime will show a slight increase even in the face of a steady price, a loss is expected in agricultural slag.

The large lime using counties of the state taxed the quarries again this year during the heavy fall shipping season and a decided increase in tonnage will be noted when complete returns are made by the manufacturers to the Soils Department of the Ohio State University. In a number of counties using but small amounts in the past will show an increase and that increase in these counties is due to the extensive lime programs sponsored by the county agricultural agent.

This year proved no exception with the soils departments of the various agricultural colleges and the extension men of the soils departments were responsible for the movement of a large tonnage of liming material. Some of the agricultural colleges have sponsored lime talks over the radio and also furnished lime posters to manufacturers for state wide distribution. The farm agricultural papers have continued to carry articles showing the value of liming sour soil and the railroads have co-operated by showing the farmer decided increases in crop production when lime had been used.

Reports from producers in Ohio show that due to a dry fall approximately 90% of the tonnage shipped this fall has been spread upon the ground and not stored in fields or barns as in the past. These reports offer encouragement for spring business.

The problem of the total neutralizing power as a factor in the sale of liming material has caused more trouble than any question so far including the question of fineness of the liming material, and it has been met by the producers in Ohio by the adoption of an agreement to guarantee a total neutralizing power no less than 95 and the producers have also adopted four standard products to include meal, ground, pulverized and carbonate form of lime, with a screen test as follows:

PULVERIZED LIMESTONE
FINENESS

Not less than 100% passing 10-mesh screen
Not less than 60% passing 100-mesh screen
Total neutralizing power not less than 95.

GROUND LIMESTONE

Not less than 95% passing 10-mesh screen
Not less than 45% passing 100-mesh screen
Total neutralizing power not less than 95.

MEAL

Not less than 25% passing 100-mesh screen
Total neutralizing power not less than 95.

PLANT LIME AS PRODUCED

80% through a 100-mesh screen
100% through a 10-mesh screen
Total neutralizing power not less than 94.

The various trade practices have been discussed and the National Agstone Association has adopted a code of ethics, and a grievance committee of three has been appointed, and a decidedly healthful condition exists among the Ohio producers, who realizing the satisfying results obtained by the farmer when liming material is applied to the soil, feel certain of a continued demand.

High-Analysis Phosphates

AT CONDA, in southeastern Idaho, the Anaconda Copper Mining Co. works extensive beds of rock phosphate. The rock exists as a vein, 6 to 9 ft. deep, lying between a wall of limestone on one side and shale on the other. It is recovered by underground quarrying methods.

The rock proper contains up to 75% B.P.L., is rather soft and carries from 4 to 6% of moisture. At the mill the rock is crushed to ¼-in. size, dried to under 1% moisture and stored in bins for shipment to the phosphate manufacturing plant at Anaconda, Mont., 300 miles away. It is of interest to note that of each ton mined here about 0.90 to 0.94 ton are recovered as dry rock in comparison with the 10 to 15 tons of material needed for each ton of dry rock produced in southern deposits. The difference in recovery is offset by increased production costs in Idaho (the underground mining vs. open pits of the south).

Sulfuric acid used to render the P_2O_5 in the rock soluble and available is produced at Anaconda from by-product gases of the ore reduction processes. The rock is calcined in hearth-type furnaces to burn out the organic contents and then ground in a Hardinge mill operating in closed circuit. The ground product, 60-mesh, is moved by screw conveyors and elevators to bins over the agitator and mixer. Decomposition of the rock is performed in three conical bottomed wooden tanks lined with acid-resisting material. Agitation is by air. The process is continuous, rock being fed to the tanks from a recording weighing machine and sulfuric acid through a measuring device. Pulp from the agitators flows by gravity to decantation tank system, which comprises Dorr thickeners and Oliver filters. The filtrate (soluble prosphates) is concentrated in vacuum evaporators and then mixed with ground rock phosphate to form treble superphosphate. This latter is allowed to set for an hour, then disintegrated and conveyed to wet storage for aging. After curing, the superphosphate is dried, screened and large pieces reground so that all passes a 6-mesh screen. It is then stored in bins from which it is drawn either to sackers or bulk loaded to cars by a suction system.—*Industrial and Engineering Chemistry.*

Work of the France Stone Company's Research Laboratory in 1929

By Dr. Herbert F. Kriege
In Charge of Tests, France Stone Co., Toledo, Ohio

TO WRITE an annual review of the activities of a research organization becomes a mixed pain and pleasure. It is, however, a good thing to record in some journal devoted to this field the steps undertaken and the progress made and perhaps even the disappointments encountered, so that duplication of effort may be minimized and encouragement may be offered. It is with these thoughts in mind that I will discuss briefly some of the efforts of the France Stone Co. laboratories to increase our knowledge of mineral aggregates and allied products in their wide range of uses.

Sampling a Quarry or the Product?

It has been apparent to me for some that the usual method of sampling a quarry is open to serious criticism. The common practice of selecting a few large pieces of stone from several or perhaps all of the strata in a quarry face is taken to be representative sampling. Even if these samples are selected without prejudice, they cannot be truly representative since they come from small localized portions of the quarry only and at best do not represent the finished product as the stone is prepared for the market. The general buying fraternity is not buying a quarry—it is buying a *product*. Therefore, it seems only logical that the *finished product* should be inspected and tested rather than the *source* of this material. The finished product and raw material may be decidedly different in quality. One particularly good or bad looking ledge in the face of the deposit may practically disappear as the material is processed. This year we therefore carried out the following plan at each of the quarries operated by the France Stone Co.

Careful examination was made of the finished product in the new storage piles. Larger sizes as 2 to 3 in. were sorted out into as many distinct kinds as could be noted. A quantitative count of these varieties was made on a sufficiently large number of pieces to be fairly accurate. A sample of each of these varieties of stone was then taken into the quarry and its parent stratum located in the face being operated. An estimate of the percentage of the face represented by each stratum was made. This quantitative relationship between raw parent material and product was used later.

Each variety of stone found in the product was then tested for its physical characteristics of hardness, toughness, abrasion loss, absorption, specific gravity, weight per cubic foot, etc., and for its chemical composition. The characteristics of the quarry product were then computed from the quantitative contribution of each variety to the whole. In addition, the modified abrasion test sponsored by A. S. Rea, Ohio State Highway Department, was made on the 2 to 1 in. and 1 to ½ in. material.

It was not surprising that in some cases a decrease in apparent quality was noted. Certainly the crushing, screening and washing operations must induce strains and impose some hardships on the raw stone passing through the plant. However, this is the way the material must be treated before it is ready for the market, and therefore should not be side-stepped. Conversely, the crushing operation at least impels a very strong selection, a survival of the fittest, and much weak friable material is crushed down to dimensions below the usual size of stone used commercially. Sometimes one hears an engineer state that he could use a crushed stone from a given quarry if it were not for his fear of a certain soft or perhaps unsound ledge. Not infrequently such material is nearly or completely removed from the sizes desired by the rigors of the manufacturing operations. Crushed stone should be judged on its merits rather than on its source.

Special Investigations

The mineral aggregate industry has been rather remiss in supplying tests and methods to the newer engineering fields, such as sanitation. As a result, vagueness capable of misinterpretation and the personal factor came in. To anyone who has tried to inspect and sample sewage disposal beds where mineral aggregates are used have some difficulties in making quantitative observations. This may prove to be a helpful suggestion in making counts as to the amounts of the different kinds of disintegration seen on the surface of a bed. A stick, such as a yardstick, is dropped at random and a count is made of the sound or distressed stone pieces immediately beneath it. A dozen or more such counts over different parts of the bed help one to arrive at a fairly accurate idea of how extensive is the disintegration of the surface pieces.

Effect of Gradation on Properties of Concrete Studied

During 1929 we continued and extended our investigations of the effect of gradation of aggregates upon the quality of cement concrete. This matter has been given a lot of rather haphazard attention, ourselves included, until our research forced us to accept its significance in explaining irregularities in the results of compression and transverse strength tests on mixes whose other factors were kept constant. Suffice it to say, that the arbitrary separation of aggregate into *"fine"* and *"coarse"* has led us into a fallacious attitude regarding aggregate. What is held together by cement is neither fine nor coarse aggregate, but is the *"combined aggregate."* This conception immediately helps us to understand why certain combinations of "fine" and "coarse" do not result in good concrete, simply because the gradation of the combination isn't right.

A full account of our investigations along this line will be presented in an early issue of Rock Products.

Stone, Slag and Gravel for Sewage Disposal Plants

During the past year we were able to make some contribution to the information regarding stone, slag and gravel in their behavior in sewage disposal plants and as railroad ballast. Data were collected not only by our own investigations but also through questionnaires sent to the health departments of the individual states and territories and to 150 of the more important railroads operating in the United States. The hearty co-operation which I received from these organizations is again gratefully acknowledged, and it should serve as an encouragement for other research workers in the mineral aggregate industry.

It was our pleasure to assist in some co-operative research for some committees of the American Society for Testing Materials and the American Society of Civil Engineers. For the former the effect of the abrasion loss of slag on its concrete-making properties is being studied, while for the latter we were engaged in determining the reliability and the reproductibility of results of the sodium sulphate soundness test.

Further investigations were carried on with the use of washed limestone sand in concrete. Several paving jobs have been completed in Lucas county, Ohio, in which this material was successfully used. The average compressive strength of cores taken from one of these pavements, seven weeks old, was 5500 lb., the mix used being approximately 1:2:3.

Designing Concrete Mixes

One phase of our work is the designing of concrete mixes and testing of concrete specimens. Many interesting contacts are made in this way. In one a high early strength cement was used in manufacturing concrete piles, nearly a thousand of which were driven at ages of 24 to 72 hours with practically no failure of the piles. In view of the low temperature of late winter, steam curing was necessary; nevertheless, the fact that 3500-4000-lb. compressive strengths at 24 hours were not infrequent, is noteworthy.

Another interesting job is the Presque Isle dock development which is being carried on in Maumee Bay by the Hocking Land and Development Co. Since this construction calls for about 70,000 cu. yd. of concrete, the design of mix and testing of the concrete have been given careful attention.

Local plant problems of operation such as water supply, fuel, etc., have come in for consideration at times. The factors affecting the quality of the product such as gradation, cleanliness, etc., have been studied and brought under control as much as possible.

With the recent acquisition of two lime plants by the France Stone Co., it has naturally been our portion to give considerable thought to the problems attached to the production and use of both dolomite finishing lime and calcitic chemical lime. Several pieces of research are under way trying to establish some fundamental facts regarding the burning properties of dolomites and limestones and the characteristics affecting the hydration processes of these limes.

It must be apparent that with this number of problems, our year is spent and much is left to be accomplished.

W. A. Hammond

W. A. HAMMOND, president of the Keystone Lime Works, Keystone, Ala., died at his home on December 21. Mr. Hammond came to Keystone from Kentucky several years ago to establish the Keystone Lime Works which he built to one of the most successful properties of its kind in the state. He was deeply interested in the development of Shelby county and active in the support of every effort for that end.

Funeral services for Mr. Hammond were held in Birmingham on December 23, followed by interment in Elmwood cemetery. He is survived by three sons, W. V., Kenneth and Morris Hammond, all of Keystone.

New Montreal Laws Would Restrict Quarry Operations

SEVERE restrictions are to be imposed on the operation of quaries in Montreal by the new by-law now before the city council, as was disclosed at the city hall by an examination of the full text of the regulation. For instance, not only may no new quarries be operated, but application must also be made to continue the operations of those quarries now in use. Quarry inspectors are to be appointed to fix the charges of dynamite or other explosive to be used, and no charge shall exceed 1000 lb. All quarries must be enclosed with high fences. All quaries operated or not shall be drained dry at all times. Notice of twenty-four hours must be given to the city of all blasting operations so that the quarry inspector may be present to direct the work. Other precautions are contained in the by-law of which but brief notices have appeared.

One provision states that no quarry blasting shall be done between 7 p. m. and 8 a. m., from April to October, and from 4 p. m. till 8 a. m., during the other months of the year. It is further forbidden to operate in the city any quarry by the method of tunnelling.

Just a Moment—

ONE of the most important lessons of life is that success must continually be won and is never finally achieved. There are those who look upon the supposed fortunate in our social efforts, who have achieved places of influence and distinction as though they had in some way gained a citadel in which they could stand secure against every attack. In truth, all they have done is to gain another level of responsibility in which they must make good.

—Charles Evans Hughes.

Included among the other things mentioned in the by-law, as regards blasting, is that, if the quarry inspector deems it necessary, such shots shall, before being exploded, be covered with rope mats or timbers or the like, according as the inspector may prescribe. In any case the public shall be warned by persons making signals with speaking trumpets or horns that explosives are about to be detonated. Watchmen shall also be stationed at such places as may be required as further warning, etc. Material extracted from quarries shall be deposited at a distance of not less than 100 ft. from the line of the lot in which the quarry is situated.

Diesel Manufacturers Elect

THE Diesel Engine Manufacturers' Association announces the election of the following officers for the year 1930: President, A. E. Ballin of McIntosh and Seymour Corp., Auburn, N. Y.; vice-president, George Codrington of Winton Engine Co., Cleveland, Ohio; chairman, executive committee, E. T. Fishwick of Worthington Pump and Machinery Corp., New York; chairman, technical committee, H. W. Dow of Nordberg Manufacturing Co., Milwaukee, Wis.; secretary and treasurer, H. A. Pratt of Ingersoll-Rand Co., New York.

This association came into active operation during the year 1929, and in a relatively short time the members have agreed upon a number of engineering standards which should be of assistance to buyers. These agreements will be formally presented in the near future in a book, "The Standards of the Diesel Engine Manufacturers' Association," soon to be published.

Eastern Rock Products Corp. Absorbs Boland Interests

MERGER of the Eastern Rock Products Corp. of Utica, N. Y., and Frank J. Boland, Inc., of Binghamton, N. Y., combining the large sand and gravel interests of both, is announced by Frank J. Boland, president of the local company.

The Boland company controls three large sand and gravel pits, located at Nimmonsburg, Chenango Bridge and upper Front street, Binghamton, while the Utica company operates 10 similar properties in various parts of the East. Under the merger agreement, H. V. Owens, president of the Utica company, becomes head of the new combine, while Frank J. Boland will act as general sales manager. Mr. Owens will have full charge of production, while Boland will supervise distribution.

Arrangements are now under way for increasing the output from the three local beds, as well as from the 10 properties of the Utica concern. Installation of a railway siding at Chenango Bridge, to reach the beds in that locality, has been started.

Fluorine-Phosphoric Acid Ratios in Rock Phosphate

A STUDY has been made of the fluorine-phosphoric acid ratios in the domestic types of phosphate rock.

Approximately constant ratios exist in the different commercial grades of Florida hard-rock, Tennessee brown and blue rock, and Western phosphates, the ratios varying somewhat with the different types of rock. The approximate fluorine content of samples of these types of phosphate may be calculated from their phosphoric acid content by the use of the ratios given in this paper.

The fluorine-phosphoric acid ratio in Florida land-pebble phosphate is not constant, but varies inversely with the phosphoric acid content. The percentages of fluorine are very constant in the different grades of this type of phosphate.

Figures are given on the fluorine-phosphoric acid ratios in Florida soft and waste-pond phosphates, and the relation between the fluorine content and the geological age of phosphate rock is discussed.—*Industrial and Engineering Chemistry.*

New Orleans Industrial Survey

FOLLOWING a thorough canvass of the New Orleans industrial zone by a prominent industrial commission, the New Orleans Association of Commerce has made available the findings in two excellent publications. All the factors of industrial location have been studied and details incorporated in the booklets. A list of natural resources, developed and undeveloped, as well as possible opportunities for various enterprises, particularly chemical, are given.

Research Activities of the Portland Cement Association for 1929

By F. R. McMillan

Director of Research, Portland Cement Association, Chicago, Ill.

TO ESTIMATE the accomplishments of a single year in a continuing program of research is difficult because the work does not divide itself into regular calendar periods. In such a program new projects are started as opportunity is presented, many of which may require several years for completion. Frequently, the results obtained in any one year on a single project are quite insignificant though the project may be a major one with ultimate accomplishment of great value. With this limitation in mind, a brief review of the research activities of the Portland Cement Association for 1929 is attempted.

Studies Relating to Durability

The work of the year has been characterized by the emphasis placed on those subjects relating to the durability of concrete. This has not been the result of a sudden impulse, but of a gradually developing program born of the growing recognition of the need for more information bearing upon the process and causes of disintegration. For the past three years, fundamental studies have been under way looking to a complete technology of the behavior of concrete. These have included among others studies of the amount of water going into combination with cement, capillary phenomena in cement pastes, and the effect of different salt solutions on the constituents of set cement. Paralleling these, there has been under development methods for measuring such qualities of concrete as permeability and the resistance to repeated freezing and thawing and alternate wetting and drying. Allied with these studies, a field survey of structures in service was begun early in 1928 to study the behavior of concrete under different conditions of exposure. The fact that the principal activities of the current year are along these lines is the culmination of all these efforts.

In the survey of structures, the field work has been practically completed during the present year. The record now embraces several hundred structures from most sections of the United States, representing wide variations in climatic conditions, sources of material, and in the attention given to the details of mixing, placing and curing. This record is proving extremely valuable in illuminating the investigations of the past and in indicating the scope and direction for future studies. For the purpose of this review, the two most important findings from this survey are briefly summarized as follows:

First, it may be stated that of all the destructive agencies which attack concrete, repeated freezing and thawing of absorbed moisture is by far the most severe. This shows the necessity for producing concrete that resists the penetration of water in those localities where repeated freezings must be encountered.

Second, though of no less significance than the first, the survey has shown that most of the defective concrete occurs in patches, as at honeycombed spots or laitance seams, while the intervening portions of the structures are in well preserved condition. This indicates the extreme importance of proper proportions, consistency and care in placing. Where the defects are due to improper materials, their distribution is more general over the exposed surface of the structure. The examples of this latter condition are much less numerous than those due to improper manipulation.

Study of Aggregates

Supplementing this structural survey, and developing naturally from it, is a comprehensive study of aggregates both in the field and in the laboratory which was begun early in the present year. By this investigation, which is under the immediate direction of a skilled petrographer and geologist, it is hoped to establish whether any of the common rock types are undesirable as aggregates and to develop tests that will disclose the presence of non-durable minerals. In this connection should be mentioned an important research project being carried out by the Highways and Municipal Bureau of the Portland Cement Association as it is one of the most extensive studies of its kind ever undertaken. This is a survey of concrete highways in which a detailed study of thousands of miles of pavement is being made to correlate the present condition of the pavement with the records of materials and methods used and with the weather conditions attending construction and the climatic and traffic conditions since being placed in use. The survey is now complete for the territory east of the Mississippi river. This, like the structural survey, is serving not only to point the way for further investigations, but to show direct and immediate ways to improve practice.

Of the laboratory investigations directly applicable to the every-day problems of making concrete to meet the destructive effects of moisture and frost, the two most significant are the studies of permeability of concrete and the effect of repeated freezing and thawing. These have been under way now for more than a year and some of the results have been published. Both programs are very extensive and will continue indefinitely. The refrigerating equipment is now being greatly enlarged to permit the freezing of a large number of specimens and to shorten the time necessary for a given number of cycles of freezing and thawing. The equipment in use in the permeability studies provides for the simultaneous testing of 44 specimens under pressures up to 120 lb. per sq. in. This apparatus has been in constant use for more than a year.

The results to date in these tests have shown that both the water-tightness of concrete and its resistance to repeated freezing are determined by the same factors which are known to govern the other desirable properties of concrete—strength, resistance to wear, bond resistance, etc. For concrete so made that all the space between the aggregate particles is completely filled with the cement-water paste, that is, without honeycombing or air voids, both the water-tightness and the resistance to frost action are determined by the proportion of water to cement (the water-cement ratio) and the extent to which the chemical combination of the water and cement (determined by the curing) is completed. Any reduction in the water-cement ratio, provided the aggregate proportions are adjusted to maintain plasticity necessary for proper placing, will be accompanied by increased water-tightness and greater resistance to freezing. Similarly, any additional curing in the early period is shown to result in a marked improvement in water-tightness. The freezing studies have not fully covered the field of curing, but the indications are that the resistance to repeated freezing will likewise be greatly improved by longer curing before exposure.

Study of Volume Changes

Another set of investigations on which considerable progress has been made during 1929 is the study of volume changes in concrete due to the loss or absorption of moisture. In the early work on this series, as in a number of other investigations of this sub-

ject which have been reported, the data did not disclose any definite laws governing the action. The work of the present year has been more encouraging as it gives promise of bringing out a definite relationship from which it is hoped actual volume changes may be predicted for given mixtures and conditions of curing.

During the year, an important study of surface coatings for curing concrete has been completed. A full report of this investigation will appear shortly as a paper before the American Concrete Institute. In this study it has been brought out that the effectiveness of any surface coating as a curing agent is measured by the extent to which it is able to keep within the mass the original mixing water. Some of the coatings tried were found to be quite effective when the results were compared to those obtained by direct application of water for only short periods of time. None of the methods tried, however, gave compressive strengths equal to complete water or moist room curing and one of them was no better than exposing the specimen to the air of the laboratory with no protection whatever. A feature of this investigation was the use of parallel groups of specimens for test in both dry and saturated condition to eliminate differences in results due to differences in moisture content at the time of test. The investigation includes wear and transverse tests as well s standard compression tests.

Fire Resistance of Concrete Units

A study of major importance on which unusual progress has been made during the year is the investigation of the fire resistive value of concrete masonry units. The construction of a furnace for these tests was completed in January, 1929. This furnace is completely equipped for making the standard fire endurance and fire and hose stream tests in accordance with the A. S. T. M. specification, with the exception that the panels are restricted in size to 5½ by 6 ft. During the year, 37 panels have been tested in which many combinations have been tried out to determine the effect on the fire resistance of the walls of such factors as cement content, consistency of mix, type of aggregate, and design of the unit itself. While this investigation can be said to be only begun, the results to date have been very instructive in showing the relative importance of many of the factors.

Admixtures—Constitution of Cement

Considerable work is being done on admixtures with particular reference to their effect on permeability and long-time strength for both dry and moist air curing. In carrying out these admixture studies, further attention has been given to the flow and slump tests as methods of measuring consistency and workability.

The study of simplified methods of test for cement continues to be an important part of the research program of the association. Recent studies sponsored by Committee C-1 on Cement of the American Society for Testing Materials have shown that much improvement can still be made in the testing of cement. The association laboratory has had an important part in these investigations and is continuing with other studies looking to the same end.

The investigations of the constitution of cement and the chemistry of its behavior being carried out by the Portland Cement Association Fellowship in co-operation with the National Bureau of Standards at Washington have continued with encouraging results.

During the year, four papers have been published as follows:

Paper 19—The Sulphoaluminates of Calcium, by Lerch, Ashton and Bogue; Bureau of Standards J of Research, April, 1929. (Research Paper No. 54.)

Paper 20—The Cause of Unsoundness in Portland Cement, by William Lerch; Concrete (CMS) **35** No. 1 and 2, July (1929), 109-112; August (1929), 115-118.

Paper 21—Calculation of the Compounds in Portland Cement, by R. H. Bogue; Ind. Eng. Chem. (Analytical Edition), October, 1929. ROCK PRODUCTS, v. 32, p. 47, November, 1929.

Paper 22—The Influence of Magnesia, Ferric Oxide and Soda upon the Temperature of Liquid Formation in Portland Cement Mixtures, by W. C. Hansen. Bureau of Standards J of Research. (In press.)

This makes a total of 22 formal papers which have been issued covering the work of this group of scientific investigations all bearing on the underlying chemistry of cement manufacture and use.

These scientific studies have progresed to the point where now many of the findings are being rechecked in cement clinker produced in an experimental rotary kiln. This kiln, which is 8 ft. in length with an inside diameter of 5 in., has a capacity of about 10 lb. of clinker per hour.

Use of Experimental Kiln

Besides its application to the study of the fundamental problems of cement composition, the kiln is being extensively used in a study of problems of manufacture such as the influence of burning temperature on the properties of portland cement, and the effect of fineness of grinding of raw materials on the temperature of burning and the properties of the resulting cement. On this latter subject, a particularly extensive program has been under way during the current year. In this investigation the grinding studies were carried on under the supervision of the Conservation Bureau of the Association, while the burning of the clinker and the tests of the cement have been the work of the research laboratory at Chicago and the Fellowship at the Bureau of Standards.

Among other studies being carried out by the Fellowship staff, one of major importance is that relating to the effect of various solutions on the component materials of portland cement and on mortar specimens made from laboratory cements of varying compositions. Allied with this, volume changes in component materials and laboratory cements of systematically varying composition are being investigated.

In addition to these major items there are always many studies under way dealing with the methods of testing concrete and concrete materials. These are frequently carried out in co-operation with committees of the American Society for Testing Materials and the American Concrete Institute, the results being used in the formulation of standards of practice.

During the year the research staff has been charged with the responsibility for certain of the educational activities of the association, particularly those having to do with the dissemination of information regarding the making, placing and curing of concrete. The transfer of this work to the research staff has made possible a closer contact between the laboratory and the construction and educational fields. This arrangement seems to be particularly timely as many have felt that research in concrete has progressed more rapidly than has the application to construction practice of principles developed.

Reactions in Burning Cement

THE EXACT amount of heat evolved during the process of combination of raw cement materials to form cement is a matter of dispute, according to A. C. Davis, works managing director, Associated Portland Cement Manufacturers, Ltd., in a recent paper in *Cement and Cement Manufacture.*

Four methods have been used to determine the value of the exothermic reaction of clinker formation, says Mr. Davis. These are:

(1) By determining the heat of formation of the component silicates and aluminates which form clinker and calculating therefrom the heat of formation of clinker itself (Richards, Le Chatelier, Dormann, Coghlan).

(2) By direct determination in a bomb calorimeter using charcoal as the source of heat (Tschernobaeff).

(3) By means of heat curves (Dittler, National Physical Lab., Janecke, Endell).

(4) By solution of the raw materials and clinker in acids and measuring the thermal effects involved (Jesser, Nacken).

The paper gives a summary of the more important determinations, which are:

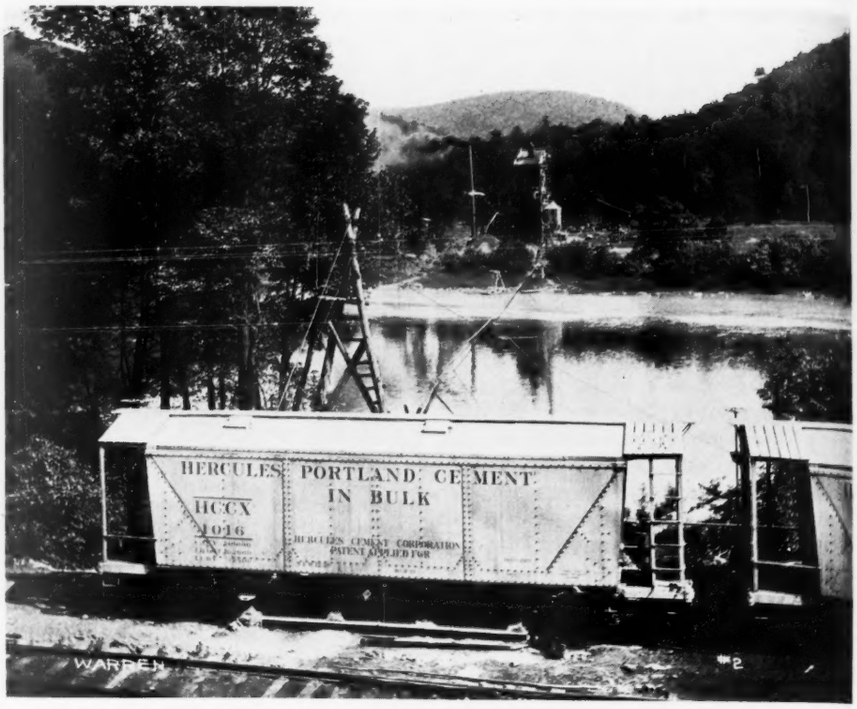
HEAT EVOLVED DURING EXOTHERMIC REACTION OF CLINKER FORMATION

Authority	Date	Equivalent in tons of coal (of 12,600 B.t.u.'s per lb.) per 100 tons clinker	B.t.u.'s per 100 tons clinker
J. W. Richards	1904	5.920	167,084,000
H. Le Chatelier	1905	2.651	74,860,000
E. C. Soper	1905	2.267	64,000,000
D. Tschernobaeff	1911	1.91–1.96	53,830,000 to 55,240,000
O. Dormann	1914	1.606–1.628	44,330,000 to 44,960,000
R. Coghlan	1920	1.416	39,977,000
R. Nacken	1922	1.428	40,323,000

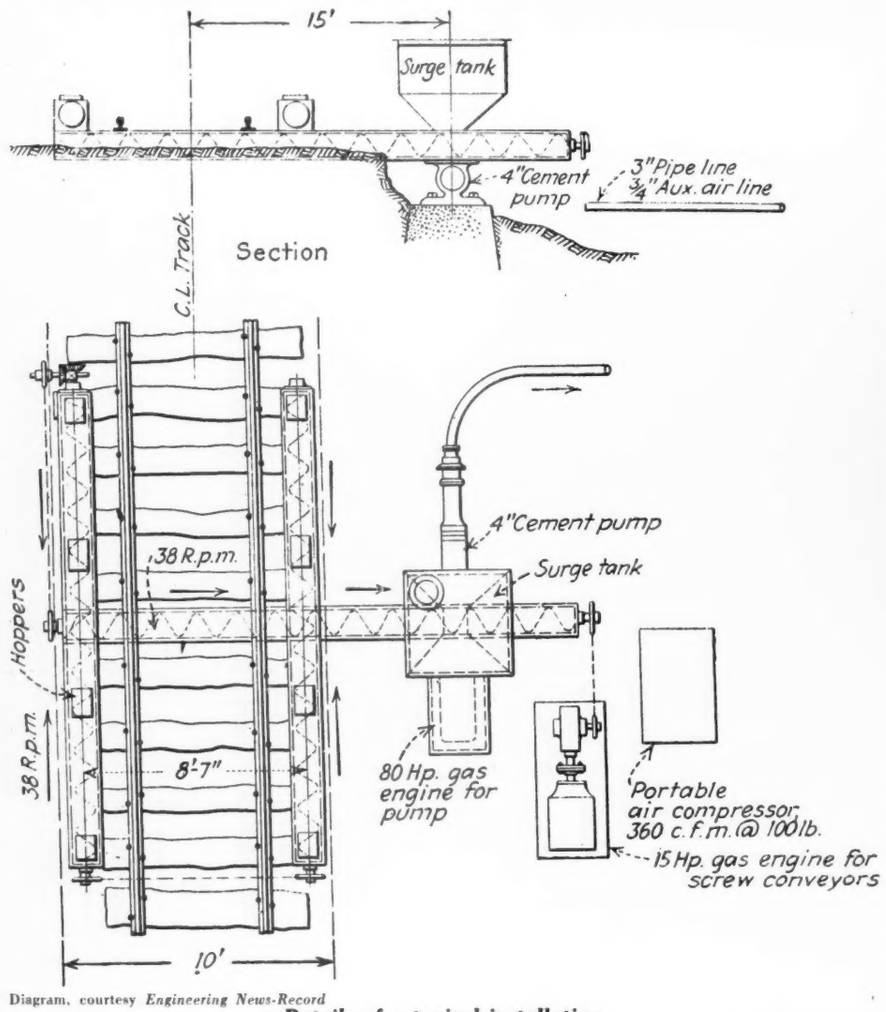
Self-Unloading Bulk Cement Railway Cars

THE HERCULES CEMENT CORP., Philadelphia, Penn., has designed, patented and put into service some all-steel, self-unloading rail carriers for bulk cement which offer interesting possibilities to the railways in their competition with bulk carrier barges and boats on the Great Lakes, the sea coast and on inland waterways. As cement manufacturers are well aware the development of self-unloading boats and barges and their growing use for cement cargoes has materially changed distribution methods in many localities and has opened up new markets to several cement mills advantageously located on waterfronts or on inland waterways.

This new railway carrier developed by the Hercules Cement Corp. may easily result in a similar shift of distribution methods and facilities. For example, the Hercules Cement Corp. is now enabled to make bulk shipments to Washington, D. C., in competition with bulk shipments by boat from Virginia. It is making bulk shipments to the New York metropolitan area, where a special barge or lighter will be used to carry the cars to various waterfront points, the barge being equipped with unloading machinery. Such bulk shipments may lead to the building of storage silos and packing plants in localities distant from the producing mill, just as the advent of the bulk cement water carrier has led to distant city packing plants with motor truck deliveries to the job.



All-steel, self-unloading railway car for bulk cement. This car is shown delivering cement for a highway project across the river



Diagram, courtesy *Engineering News-Record*

Details of a typical installation

Special screw conveyor devices are placed alongside the unloading tracks

Thus far the Hercules railway carrier has been used largely for bulk cement shipments to regular customers, including construction contractors.

The car itself is a hopper-bottom (the hopper the long way of car) steel car with four discharge hoppers or gates along both sides, as shown in the accompanying view. Compressed air ports are provided at the gates and elsewhere to loosen up, or "float" the cement in the car, so that it will flow

readily. The discharge hoppers or gates feed into a screw conveyor device which may be placed in the railway track at any point without disturbing the ties or rails. This device may be permanently located, or may be portable to use at any construction job. The screw conveyors feed either a chain bucket elevator or a Fuller-Kinyon cement pump, which conveys the cement to storage.

The car itself is built by the Standard Steel Car Co., Pittsburgh, Penn., and carries 80 tons of bulk cement—just double the ordinary box-car load of sacked cement. A car can be unloaded in from 15 minutes to 2 hours. In the car lighter, under construction for service in New York harbor, the screw conveyors and Fuller-Kinyon pump will be a permanent part of the lighter equipment.

Sand Company Sold

THE Spruce Pine Sand and Gravel Co. has been sold to Col. L. E. Wilson, of Sheffield, Ala., and associates, it is announced, and in future will be operated as the Spruce Pine Sand Co. The consideration was not made public.

Col. Wilson and his associates have operated the Tennessee Sand and Gravel Co. several years, and the Spruce Pine properties will be operated in connection with the former company, it is thought.

Miss Rose Collins, who has been active manager of the Spruce Pine Sand and Gravel Co. approximately nine years, has not announced her plans, but it is probable that she will not be connected with the new organization.

The plant and property represents an investment of $150,000, there being approximately 400 acres in the tract purchased by the new organization. The capacity of the plant will be increased by the new owners. They will specialize in building plaster and asphalt sand.

The Tennessee Sand and Gravel Co. owns two dredges, one steamer, a gasoline tow boat and a large number of dredges.—*Tuscumbia* (Ala.) *Times.*

Northwestern States Portland Gives Christmas Bonuses

THREE hundred and eighty employes of the Northwestern States Portland Cement Co. received bonus checks from the company totaling $30,000. The size of the checks varied with the length of service of each employe. A short time ago the company announced the purchase of nearly a half million dollars of group insurance which was also presented to the cement plant workers as a Christmas contribution to their welfare.

The insurance received by the employes is in three groups, one group getting $3,000 each, another $2,000 and a third $1,000 each, depending on the classification of the risk.

A modern ready-mixed concrete plant using the new system

The company will pay the first month's premium on the insurance and all but 50 c. a month for each $1,000 in insurance thereafter.

Those receiving the insurance include the officers and sales force, as well as the plant personnel.—*Des Moines* (Iowa) *Register.*

Waller Company to Open New Sandstone Quarry

WALLER BROTHERS STONE CO., McDermott, Ohio, announced recently that they are opening a branch sandstone quarry near Lancaster, Ohio. The firm has leased a large tract of land in the Hocking valley along the Hocking Valley railroad seven miles from Lancaster. Quarrying equipment, including derricks with a 30-ton capacity, has been ordered and is en route to the quarries.

Clark Waller, member of the firm, will be superintendent in charge of the Lancaster branch.—*Portsmouth* (Ohio) *Sun.*

Canada Gypsum to Build Plant at Calgary

THE Canada Gypsum and Alabastine, Ltd., is to establish a plant in East Calgary, and it is announced by W. E. Armstrong of Winnipeg, western manager of that company, that excavations for the buildings will be started at once. A site of eight acres has been secured.

Canada Gypsum is a large manufacturer of gypsum and lime products with gypsum products mills at Caledonia and Lythmore in Ontario, Montreal, Que., Winnipeg, Man., and Port Mann, B. C. Lime products mills are situated at Paris, Elora and Teeswater in Ontario.—*New York Journal of Commerce*, New York City.

W. H. Sanders Heads Indiana Sand and Gravel Association

AT THE recent annual meeting of the Indiana Sand and Gravel Association, held in the Claypool Hotel, Indianapolis, Ind., W. H. Sanders was elected president of the association for 1930. Mr. Sanders is sales manager of the Western Indiana Gravel Co., Lafayette, Ind., which operates eight sand and gravel plants located in Indiana, Illinois and Michigan.

Mr. Sanders succeeds Harry Nattkemper as president of the association.

W. H. Sanders

Slate in 1929

By Oliver Bowles

FOR the past six years the total annual sales of slate have fluctuated between $11,380,000 and $12,575,000. Pennsylvania is the chief producer; Vermont, second; New York, third; Maine, fourth, and Virginia, fifth. Pennsylvania produces roofing, structural, electrical and blackboard slate; the Vermont-New York district, the same product as Pennsylvania except blackboards; Virginia, roofing slate; while in Maine the chief production is electrical slate with some structural, blackboard and roofing.

Industry Feels Building Recession

The slate industry, like most of the industries providing building materials, felt the effects of the recession in residential construction work which affected a large part of the territory where slate finds its chief market. These effects were most in evidence during the latter months of 1929. The fireproof character, the attractiveness and the permanence of slate recommend it for wide use as a roofing material for all types of construction, but it meets with many competitors. Growing restrictions against inflammable roofing materials in urban centers open up wider fields for roofing slate.

Conditions in Pennsylvania were fairly satisfactory in 1929. Structural slate sales were about equal to those of 1928, or possibly a little higher, but total sales fell slightly below those of 1928. Business was dull during November and December, and restricted production is to be expected during the early months of 1930. The Maine industry has maintained normal activity. The Vermont-New York district has the least satisfactory showing in roofing and electrical products of any of the slate regions. Several important operations have shut down or are working on a part-time basis. The 1929 roofing-slate production in this territory will probably be considerably lower than that of 1928.

Marketing Problems

The big problem in all the slate regions is to find a market of sufficient extent to absorb the normal output of the quarries. During 1929 marketing companies and associations have exerted a growing influence, particularly in Pennsylvania and Virginia. Publicity and promotional work on their part are undoubtedly responsible for greater sales than would otherwise have been effected. Sales organizations in Vermont and New York have been effective only in the marketing of structural slate and that used for floors, walks and walls. Marketing in several districts has been assisted in some degree by improved freight-rate classifications.

To Establish Uniform Cost-Keeping

Price-levels of roofing slate were reduced to some extent during the latter part of the year. At times sales are made below listed prices, and in some instances at prices below the actual cost of production. To improve this and other economic conditions in the industry, earnest efforts have been made in establishing a better cost-keeping system. At the annual meeting of the National Slate Association held in New York in January, 1929, a cost-keeping committee was appointed. The committee was later enlarged and several outside accountants took part in the conferences which were held. Assistance of particular value was rendered by the accounting firm of Eckert, Degan and Palmer of Easton, Penn. The U. S. Bureau of Mines, working in co-operation with this committee, has prepared a cost-keeping system which it has published as a Report of Investigations, Serial 2971, under the title, "A System of Accounts for the Slate Industry." Practical application of the system proposed will no doubt tend to improve economic conditions, for it is believed that a more accurate knowledge of the cost of producing slate will exert a strong influence toward stabilizing prices.

Wire-Saw Progress

The wire saw is now in use by about 20 companies in Pennsylvania and one company in New Jersey. Its use in making primary cuts in quarries is accomplishing a remarkable saving in cost and a decided reduction in the proportion of waste.

Marbleized and lacquered slates in various colors and patterns are finding wider use. Decorative wainscoting, mantels, table tops, radiator covers and kitchen and bathroom wall tile are some of the products now made. This method of surface treatment also permits the utilization of small pieces of slate for the manufacture of decorated novelties, such as checkerboards, book ends, clocks, ash trays and lamp bases. Slate is also finding wider use for floors and walks; very attractive sidewalks, store entrances and display window floors are made of slate slabs of various colors. They may consist of irregularly shaped fragments or of rectangular sawed slabs of various sizes fitted together. A plant was recently established at Poultney, Vt., for the manufacture of standard sizes of slate flooring tile. The tile are cut so accurately that the joints between them are very narrow and easily cemented. An unusual new use employed by some Tennessee architects in university and church buildings is a combination of slate with building stones in wall construction.

Properties of Slate

Considerable progress has been made toward a more accurate determination of the properties of slate in their relation to use. Committee D-16 of the American Society for Testing Materials is sponsoring better classification and more adequate specifications, the latter involving studies of properties and methods of tests. The U. S. Bureau of Standards and several college laboratories, notably those of Lafayette College, Lehigh University and Rensselaer Polytechnic Institute, have conducted tests of the physical and chemical properties of various slates and are endeavoring to standardize the methods of testing; the University of Cincinnati is conducting tests on the weathering properties of slate; the Federal Specification Board is taking steps to establish a standard specification for roofing slate for government use. It is to be expected that these efforts will in time develop a mass of authoritative information which will enable slate operators to classify their materials more definitely and to direct each type to the use for which it is best adapted. The various accomplishments in these lines of research will be discussed at the annual meeting of the National Slate Association to be held in New York, January 20, 1930, at Hotel Commodore.

Imports

Slate importations have been increasing considerably of late years, though in 1928 they were only about half as great as in 1927. This, however, may be only an apparent falling off, as a tariff ruling has been in effect which permits unmanufactured slate to enter duty free and such slate in unrecorded. Operators claim that considerable slate in mill stock form enters on the free list. Imports of manufactured slate increased greatly in 1929. For the first 10 months of the year the importations were valued at $87,252, such figures being subjected to later correction. This amount is considerably greater than the total for 1927; nearly twice as great as the total for 1928 and about 32 times as great as the total imports for 1922. The chief foreign sources of slate in order of present importance are: Italy, Portugal, France and Norway. Slate producers are giving careful consideration to the possible future effect on their industry of increasing importations.

Highway Research in 1929

By R. W. Crum
Director, Highway Research Board

MOST of the state highway departments, many of the engineering colleges, many commercial laboratories and the United States Bureau of Public Roads are carrying on research programs in greater or less degree. The problems relating to highways and highway transport are many and important and there is a growing realization that co-ordination of effort and correlation of results will be needed if the maximum benefits are to be derived from this research effort.

The Highway Research Board has prepared a highway research program, stating and analyzing the needs of the situation and calling attention to the needed research of immediate importance. Such a program will be subject to continual change. Final answers will be reached at times, new projects must be frequently added and changing conditions will no doubt render some work valueless even before it is completed. Having a program outlined, it is our hope to keep it up to date continuously.

Research Planned

Such a research program as this will not be of much value unless the necessary experimental work is accomplished, the results thoroughly studied and sound conclusions drawn and put into practice. The Highway Research Board therefore plans to do much more than merely outline a research program. The plan of activity may be briefly stated as follows:

1. To draw up a comprehensive program of highway research.
2. To compile and have available for dissemination, information and references on the existing status of knowledge of the various projects.
3. To compile and keep up to date lists of the current research projects throughout the United States.
4. To promote with the various research agencies the carrying on of the experimental work recommended in the program.
5. To conduct special investigations of national scope.
6. To correlate the work of the various investigators, to study the results of research work as they become available, and to draw sound and usable conclusions wherever possible.
7. To disseminate research information.

Committees Being Reorganized

The committees of the Highway Research Board are now being reorganized in order to carry on this work more efficiently. There will be general committees on (1) Administration and finance; (2) Transportation; (3) Design; (4) Materials and construction; (5) Maintenance, and (6) Traffic. The work will be largely carried on through small sub-committees in charge of specific research projects.

Summaries of the Principal Papers, Highway Research Board Meeting

REPORT OF COMMITTEE ON CO-ORDINATION AND PROGRAM — A PROGRAM OF HIGHWAY RESEARCH — Statements and analysis of highway problems as they exist today with suggestions as to needed research in their solution are presented. The problems are discussed under the headings of "Administration and Finance," "Transportation Costs," "Highway Design," "Materials and Construction," "Maintenance" and "Use of Road." The major questions to which the answers are still incomplete are: (1) How is the money to be raised? (2) What will the roads and their use cost? (3) What design will serve the traffic adequately at least cost for construction, maintenance, and vehicle operation? (4) How shall the most efficient and safe use of the roads be arranged?

The report also outlines the functions of the Highway Research Board.

APPLICATION of Aerial Mapping to Highway Construction—Sarason—It is believed that a good many highway problems can be solved better and more economically by the application of aerial mapping. This is especially true in planning a system of highways and in making new locations. The United States has fallen behind in the application of aerial photography to engineering work. The needed research will be greatly stimulated when engineers become acquainted with the possibilities of aerial mapping. Pictures of the latest instruments.

SOIL INVESTIGATIONE in Russia —Krynine—A special Highway Research Bureau, with a well equipped laboratory and staff of field workers, was established in 1923 by the Russian government. Professor Krynine tells of the extensive soil investigations. Inasmuch as 99% of the 2,000,000 miles of road in Russia have only an earth surface, most of the effort has been directed toward their improvement. "Preparation of Soil Profiles," "Design of Standard Soil Mixtures," "Study of the Permanently Frozen Soils" and "Study of the Rolling Process" are discussed. Among the important developments are the "Opaloscope" for the optical study of size and shape of soil particles and the "Reflectometer" for the optical determination of water content of soils. Both of these were designed by G. I. Pokrowski.

REPORT OF COMMITTEE ON HIGHWAY TRAFFIC ANALYSIS—This report discusses the following topics in the light of accumulated experience and available data: "Toll Bridges and Toll Highways"; "Traffic Planning as an Engineering Problem"; "Type of Transportation to Central Business Areas"; "Motor Vehicle Parking or Stopping"; "Installation" and "Operation of Traffic Control Signals"; "Train Actuated Signals at Grade Crossings"; "Vehicle Actuated Traffic Control Signals"; "Signalizing of Main Arteries"; "Results from Elimination of Parking on City Streets"; "Theoretical Limits of Traffic Capacity"; "Measure of Traffic Congestion"; "Traffic Lane Markings"; "Responsibility for Providing for Pedestrian Traffic"; "Left Turns"; "Independent Routes for High and Low Speed Traffic"; and "Forms for Traffic Investigations." Important conclusions are: "That the importance of parking as an adjunct to the shopping business is exaggerated"; that "It is not the responsibility of the public to provide either curb parking or vehicle storage space"; that "Advance signals should be used with train actuated crossing signals, where 500 feet clear view is not possible"; that "Traffic control signals should not be used to control traffic at intermediate intersections"; that "Left turns at intersections should be made on the inside with the green light."

In discussing the results of twelve years of traffic counts in Maryland, A. N. Johnson calls attention to the greatly increased use of the roads during inclement weather and concludes that: "Highway departments are amply justified in employing every practical means for the improvement of road surfaces during bad weather."

THE MATHEMATICAL Theory of External Loads on Closed Conduits in the Light of the Latest Experiments—Marston—Based on experiments conducted by the Engineering Experiment Station, Iowa State College, extending over 20 years. Measurements of loads produced by embankments, and correlation tests showing the relation between strength of pipe by test and height of fill that causes failure.

REPORT OF COMMITTEE ON MAINTENANCE — A study of specifications, methods of purchase, history of development, and rental rates of maintenance equipment as developed in the practice of the various highway departments. Also the committee report correlates available information on the various methods and materials

used in light oil treatments, mat surface treatments, retreads and various types of asphatic mixtures. Costs and service records of the various combinations of materials, and study of their suitability for use under various climatic and traffic conditions are included.

FORMATION OF WASHBOARDS IN GRAVEL HIGHWAYS—Dana—Extensive experiments conducted by the Engineering Experiment Station of the State College of Washington from 1926 to 1929 show that the use of low pressure shock absorbers, and moderate vehicle speed greatly decrease the formation of these troublesome corrugations. The experiments included studies with laboratory models, tests on a circular test track 175 ft. in diameter, and tests on 1.25 miles of straight highway, especially provided by the Washington State Highway Department. The test conditions were very carefully controlled throughout. "The results of these tests and experiments would seem to indicate that there is a possibility of solving the "washboard" problem, not by attacking it from a maintenance standpoint, but by controlling the conditions and characteristics of the car itself. Although cars equipped with balloon tires did not cause corrugations, the problem is still of importance by reason of the many trucks and vehicles not so equipped."

Pavement Concrete Control

CONTROL of Materials and Mixtures for Concrete for Pavements — Crum — Describes the methods used by the Iowa State Highway Commission upon the construction of 700 miles of concrete pavement in 1928 to insure concrete of uniform quality containing a quantity of cement within 1% of that estimated in the specifications. Methods for field determination of the factors needed for maintaining accurate measurement of materials, such as specific gravity, contained moisture, and absorption of aggregates, are given. Methods and appliances for weighing aggregates and measuring water are discussed.

Results are evaluated by means of transverse tests made in the field, compressive tests of cylinders and cores and daily records of quantities of materials used. The average over-run in cement used for all jobs was 1.2% and 52% of the entire mileage was within 1.0% of the estimated quantity of cement. As these figures include the over-runs due to extra depth of slab, the objective was substantially attained. The strength tests show marked improvement in uniformity. Range in average strength of jobs—compression age 26 days—maximum 3404, average 4338, minimum 3732 lb. per sq. in.; transverse age 10 days, maximum 725, average 600, minimum 454 lb. per sq. in. The mean variation from the average of strengths of individual specimens for the various jobs ranged from 4.6% to 17.8% for transverse and from 4.7% to 17.2% for compression tests. These figures are shown in comparison with corresponding data from earlier tests under much less complete methods of control. Effects of different proportions and kind of aggregate, and relations between transverse and crushing strengths as indicated by these data are discussed.

WATER CONTROL at Concrete Mixers — Myers and Lang — Results of laboratory tests by the Minnesota Highway Department and field tests made by the Iowa Highway Commission. In the discussion sources of inaccuracy in water measurement are indicated and remedies suggested. Experience with latest types of measuring devices.

REPORT OF COMMITTEE ON HIGHWAY FINANCE — A program of research needed to discover the principles governing proper methods for raising money for highway use, and proper distribution of these revenues. Relative use of different classes of roads, and suggested research relating to distribution of the proceeds of motor vehicle taxes. Suggestions are made as to determination of benefits to abutting property, and circumstances justifying general taxation. Use of bond issues.

Highway Finance

REPORT OF COMMITTEE ON HIGHWAY TRANSPORTATION COSTS—The report proposes a method of calculating highway transportation cost based upon computation of costs of road maintenance and construction and of vehicle operation. The research needed to obtain the correct data for the solution is indicated.

REPORT OF SPECIAL INVESTIGATION OF CURING OF CONCRETE PAVEMENTS — This investigation has been in progress since February, 1929. A progress report will be made, covering a study of existing information, a field survey of surface condition of pavements, and the status of various co-operative experiments being carried out as suggested by the special committee.

REPORT OF COMMITTEE ON STRUCTURAL DESIGN OF ROADS—During the past year the Committee on Structural Design of Roads has been devoting its attention to the formulation of a program of research in the field of structural design. Considerable progress has been made and a comprehensive list of topics for investigation has been compiled. Although a complete report was not presented by the committee this year covering its outline of research, this work was briefly summarized at the annual meeting in order to point out the value of such an outline. Also a paper by F. H. Eno was presented through the committee.

THE INFLUENCE OF CLIMATE on the Building Maintenance and Use of Roads in the U. S.—F. H. Eno—The effects of temperance, frost, sunshine, wind, humidity, precipitation, run-off and evaporation upon various phases of highway activities, and the application of climatological data thereto are discussed. The climatological characteristics of various sections of the United States are summarized for a 20-year period diagrammatically. References to publications of the U. S. Weather Bureau, U. S. Geological Survey, and American Society of Civil Engineers. Outline of needed research.

REPORT OF COMMITTEE ON CAUSES AND PREVENTION OF HIGHWAY ACCIDENTS—Statement and analyses of the problems upon which help can be expected through research, and suggestions as to needed research projects.

Potash from Leucite and Alunite

WITH THE PASSAGE by Congress of the Winter Bill (H. R. 496) during the past session, the way is open for a further extension of investigations into the potash resources of the country, says the United States Bureau of Mines.

Previous governmental investigations had been limited to the exploration for potash deposits in Texas and New Mexico, which geological data indicated as being present but which had not been proven. The United States Geological Survey participated by locating the most promising sections for drilling. Following this the Bureau of Mines has carried on a comprehensive diamond drilling campaign and laboratory study of the drill cores.

By the provisions of the Winter Bill, investigations are authorized to cover other potash minerals, such as the leucites and alunites, greensands and other potash ores. The bill provides that investigations shall be carried on by both the Bureau of Mines of the Department of Commerce and the Bureau of Chemistry and Soils of the Department of Agriculture.

J. R. Thoenen, of the Bureau of Mines, is preparing to make a field study of the deposits in Wyoming and Utah with particular reference to the economic possibilities in exploiting these ores and the collection of samples for technologic study.

Index to A.S.T.M. Standards and Tentative Standards

A COMBINED index to all A. S. T. M. standards and tentative standards in effect as of September 3, 1929, has been brought out by the American Society for Testing Materials. A complete list of the 390 standards and 173 tentative standards indexed appears in the 1929 A. S. T. M. year book and in the 1929 supplement.

The index is designed to be of service to those familiar with the society's standards in locating any specification or method of test in the bound publication in which it appears, and, as well, to those interested in ascertaining if the society has issued any standards on a specific subject.

A price list gives the prices of the bound publications in which the standards and tentative standards appear and the prices of standards in separate pamphlet form.

Progress and Present Status of Research on Mineral Aggregates for Asphaltic Type Roads

By Prevost Hubbard
Chemical Engineer, The Asphalt Association, New York City

MINERAL AGGREGATES constitute from 80 to 95% of asphalt paving compositions and, therefore, exert a very great influence upon the physical characteristics of such compositions. In general, they have not received the study warranted by their importance as related to the characteristics and life of the road or pavement in which they are used. Most of the tests to which they are subjected, particularly the coarse aggregate products, are hang-overs from the period during which waterbound pavements were considered adequate for the class of traffic which then existed. From this period have been handed down certain standards of acceptability which are but poorly suited for their use with asphaltic materials, as many products which are quite unsuited for waterbound construction may be advantageously used in certain types of asphalt construction. Fine aggregates have rarely been evaluated on any other basis than their mechanical analysis and visual examination, and so far as asphalt paving mixtures are concerned it is believed by many of our leading technologists that our ideas relative to grading limitations have had no theoretically sound basis.

Considerable activity has recently been shown in connection with a more rational study of mineral aggregates and in an endeavor to round up our present information regarding them a symposium on mineral aggregates was held at the 32nd annual meeting of the American Society for Testing Materials in 1929. This symposium embraced many excellent papers dealing with aggregates for various purposes and included three papers having to do with aggregates for bituminous mixtures. The need for future research was very capably presented in a paper by F. H. Jackson,* engineer of tests of the U. S. Bureau of Public Roads.

A committee on mineral aggregates recently appointed by the Advisory Board on Highway Research of the National Research Council held an organization meeting during December, 1929, for the purpose of preparing a comprehensive scheme of research to cover certain objectives which seem to it to be of greatest importance. If this plan is conscientiously followed it is probable that our knowledge of just what characteristics should be sought for and specified in mineral aggregates for various purposes will be greatly increased and that the outcome will be the elimination of certain unnecessary requirements now commonly specified, and a simplification of requirements which will work to the advantage of the producer as well as to the consumer. As a matter of fact results already obtained in certain lines of research recently conducted point very strongly in this direction.

Summary

MORE than 25,000,000 tons of mineral aggregate are used annually for constructing asphaltic type highways. Probably 50,000,000 tons more are used on existing highways for resurfacing, etc.

Much interest and much research work has been done and is being done to develop cheap surfacing for secondary highways. This will be one of the largest outlets for mineral aggregate in 1930 and for several years to come.

Also, in airport construction, these same types of paving are much used; and the building of airports is getting to be a big feature in the construction industry.

The article gives a summary of research to date on the type and characteristics of mineral aggregate required for this kind of construction.

Uniformity of aggregate is its prime requirement.

Evaluation of Mineral Aggregates

Until recently one of the greatest handicaps to intelligently evaluating mineral aggregates for asphalt paving mixtures has been lack of suitable methods for determining the physical characteristics of finished mixtures. This condition is being rapidly corrected and certain tests for determining resistance to displacement have been devised during recent years which are proving of great service in this connection. Most of the investigations so far conducted have been on fine aggregate mixtures, but it is believed that the same principles which have been developed for such mixtures are equally applicable to the coarse aggregate mixtures. With these tests it is now possible to determine the relative value of tests on the mineral aggregates alone as effecting the characteristics of the final product which, after all, is the primary consideration.

Just as resistance to crushing and cross bending are important for combinations of mineral aggregates and hydraulic cements or monolithic concrete, stability or resistance to displacement under traffic are important for asphaltic mixtures Mineral aggregates in themselves may or may not possess a considerable degree of inherent stability or resistance to displacement under traffic, and this factor must always be taken into account in any rational use of mineral aggregates for asphalt construction. As the mineral aggregate used in an asphalt paving mixture is more frequently composed of a combination of two or more individual aggregates, it is evident that the characteristics of the individual products is of less importance than that of the combined products and that the problem of evaluation is thus largely one of design or proportions.

Angularity and Compaction

Angularity of individual fragments is of considerable assistance in securing interlocking of the mineral aggregate so as to produce stability and this characteristic in coarse aggregates is of primary importance in certain types of asphalt construction, such as the asphalt macadam. For such construction a crushed or broken product is essential for the coarse aggregate. Density of the compressed mineral aggregate, while of extreme importance in most of the mixed types of construction, is not so essential in asphalt macadam and is sacrificed in order to make possible the penetration method of applying the asphaltic binder.

On the other hand, density is of material aid in securing stability so that in the design of pre-mixed paving compositions it is quite possible to use both coarse and fine aggregates which are not strictly angular and the matter of proper proportions becomes the major consideration. In such mixtures uncrushed gravel, properly screened, may make a very satisfactory coarse aggregate, but when so used it is essential that the voids between the coarse fragments be thoroughly packed with a mortar of fine aggregate and asphaltic cement.

Toughness, Hardness and Resistance to Abrasion

Of all the physical tests, resistance to abrasion is usually considered as of greatest importance and is most commonly included in specifications for crushed stone products,

* Needed Research on Mineral Aggregates"; Proceedings of the American Society for Testing Materials, Vol. 29, Part 2, technical papers.

particularly when the larger sizes are required. Of course the use of material which will abrade and wear away rapidly under traffic is not desirable, but it has been found that if the proper amount and character of asphaltic cement is incorporated with a relatively soft mineral aggregate little or no abrasion will result from traffic on the finished pavement, and this characteristic is not therefore of as great importance as in other types of pavements. This is particularly true of hot mixed paving compositions. For asphalt macadam, as it is usually constructed, a relatively high wear resistant aggregate is still considered preferable in view of the tendency of the softer aggregates to abrade during initial compression before the asphalt is applied.

The toughness of a coarse aggregate for use in wearing courses is of probably greater importance than any other physical property in so far as its use in the mixed types of construction is concerned, as these types are designed to carry but little excess of asphalt over that needed to bond the aggregate as it originally exists, and later fracture of the coarse fragments under service conditions is apt to cause raveling to take place

Gradation and Stability

In asphalt macadam construction, uniformity in size of the individual fragments of coarse aggregate is of great importance from the standpoint of securing a uniform distribution of relatively large voids after initial compaction which will allow the asphalt to penetrate through the wearing course For other types of pavements, gradation in sizes of the composite aggregate is of importance in securing density, and this is usually controlled by proportioning at least two and often three individual commercial products. The laws governing relationship between gradation and density of compacted mixtures have, however, never been placed upon a sound basis, the result being that most specification requirements for grading are purely empirical. Moreover, recent researches have shown that influences other than gradation and density after compacting often exert a very powerful influence on the stability of asphalt paving mixtures and that the properties producing this effect are not directly indicated either by gradation of the aggregate or its general appearance as determined by visual scrutiny or examination under the microscope. In other words, certain important characteristics governing stability are not susceptible to description in specifications dealing with the mineral aggregate alone. The stability test on finished mixtures has so far been the only means of ascertaining the relative value of mineral aggregates from this standpoint.

With regard to gradation, it now appears that uniformity of gradation is probably of far greater importance in the mineral aggregate than its exact screen or sieve analysis. Segregation is the bane of engineer and contractor in connection with the use of mineral aggregates for paving. Lack of uniformity in supply greatly complicates the problem, but segregation during storage and handling of originally uniform products may cause just as much trouble as original lack of uniformity, and there is much need for careful investigation of methods of handling aggregates so as to reduce segregation to a minimum.

As previously stated, most of the investigations having to do with stability of asphalt paving mixtures and the effect of variations in characteristics of the mineral aggregate upon stability have so far been confined to fine aggregate mixtures of which the sheet asphalt surface mixture is typical. Such mixtures are composed of graded sand, mineral filler, such as limestone dust and asphalt cement.

Fine Aggregate Mixtures Studied

In such mixtures the sand, although it all passes a 10-mesh sieve, may be considered as coarse aggregate and the mineral filler as fine aggregate. Studies of such mixtures have demonstrated the following:

1. Where a bituminous mixture is composed of an admixture of two or more mineral aggregates in combination with a bituminous cement, evaluation of the individual aggregates, with reference to the stability that may be secured in the mixture, can be only roughly approximated. In other words, the proportions in which the aggregates are combined is such an important consideration that it is necessary to take into account the effect of variations in proportions. Thus, while two sands may be approximately evaluated from the standpoint of stability, the stability produced in a bituminous mixture with either of these sands will be very greatly influenced by the characteristics and proportion of mineral filler incorporated in the mix.

2. Within certain limits the addition of increasing amounts of mineral filler produces increasing stability in the mixture, but the relative effect of two different fillers combined with a single sand may vary greatly and the reason for such variation has not been disclosed by any of the tests for mineral fillers at present covered by specifications.

Sands from Different Sources Affect Stability

3. When using the same mineral filler in combination with two individual sands to produce mixtures as nearly identical as possible the stability of these mixtures may be entirely different if the sands have been obtained from different sources, even though they have been brought to identically the same mesh composition by sieving and recombination. Such characeristics of the sand other than its mechanical grading is therefore responsible for this difference and the property responsible is not disclosed by any of the tests to which sands are usually subjected. Just what characteristic is responsible remains to be ascertained. From the above it seems entirely probable that heretofore too much importance has been assigned to the screen or sieve analysis of mineral aggregates and it now appears to many investigators that the principal value of the screen or sieve analysis lies in ascertaining that a reasonable distribution of the various size particles exist, and that no particular significance relative to density or stability may be attached to exact limitations in percentage of any individual size or sizes which may be present.

It is believed that the ultimate effect of work already done, as well as future investigations, will be to materially broaden specifications for gradation of mineral aggregates, which will make available, for certain classes of work, products which have heretofore been excluded and will also simplify the problem of production and supply on the part of the aggregate producer.

Standards Yearbook for 1929

THE RECENTLY issued volume contains outlines of the activities and accomplishments of the U. S. Bureau of Standards and other government agencies. Work accomplished in 1928 by state, county and municipality agencies as well as that done by various technical societies and trade associations is discussed in brief. Programs for future work of these organizations and the methods employed by them to encourage or facilitate the use of standards and specifications is outlined briefly in the annual yearbook.

Among the special features of the present yearbook is an outline of methods employed in standardizing commercial weights and measures. There is also featured the present attempt to simplify the calendar by introducing an internationally standardized month. This subject is discussed in special contributions by Charles F. Marvin, chief of the United States Weather Bureau. Outlines are given of the activities and recent accomplishments of various foreign national standardizing bodies. Included also is a bibliography of recent publications relating to standardization contributed by courtesy of William Adams Slade, chief, division of bibliography, Library of Congress, and a brief discussion on International Co-operation in Standardization, by John Gaillard, of the American Standards Association.

The standards yearbook is proving of much value to manufacturers, industrial experts and engineers, as well as to purchasing agencies both governmental and general. It can be obtained from the U. S. Government Printing Office, Washington, at a price of $1 per copy.

Part of the delivery truck fleet for ready-mixed concrete

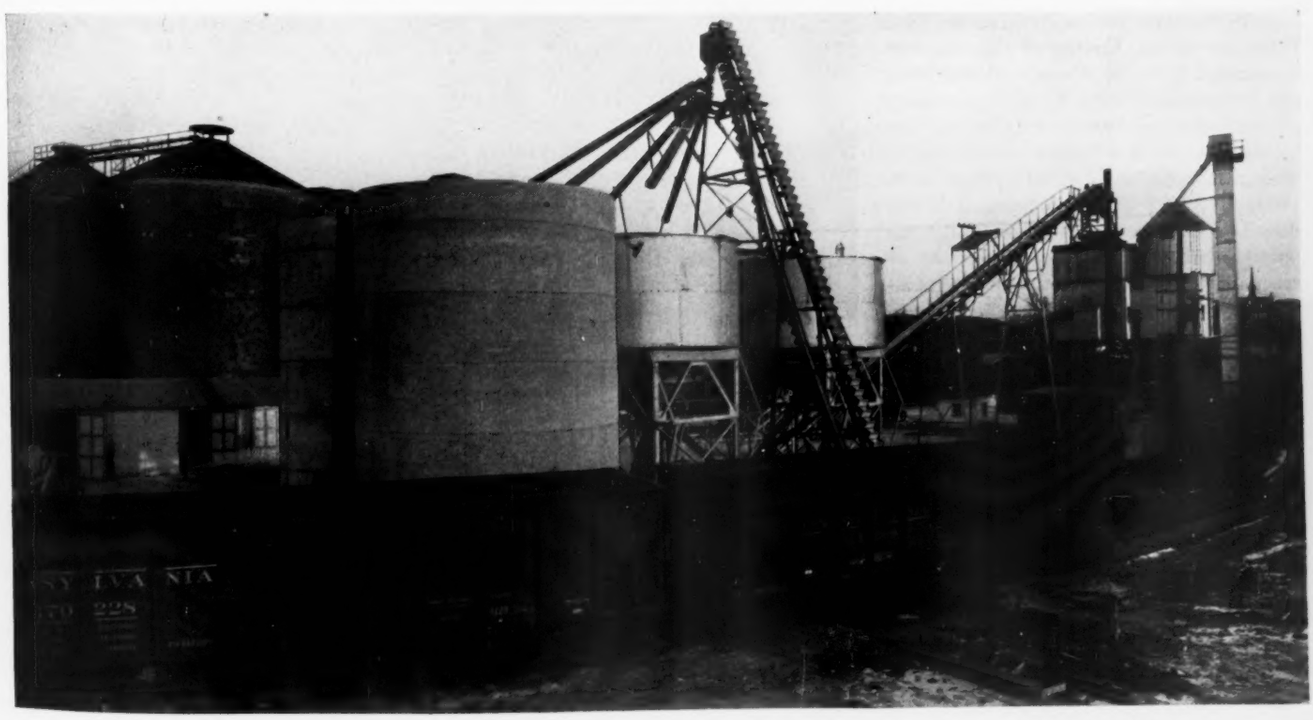
Promotion and Sale of Ready-Mixed Concrete

Based on Experience of the Author in Cincinnati, Ohio

By Arthur C. Avril

President and General Manager, Avril Tru-Batch Concrete, Inc.
Cincinnati, Ohio

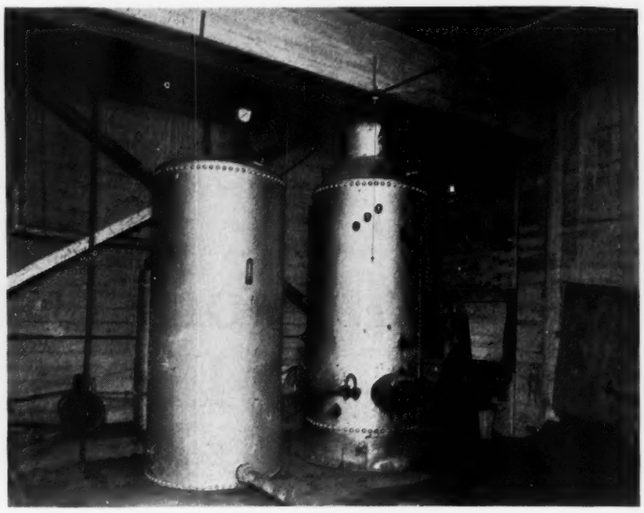
IN PROMOTING the use of ready-mixed concrete, we had no tangible data with which to work, other than that it was being well received in other cities. With this in view, our first move was to circularize the building trade with a series of sales letters which kept them posted on the progress we were making in the construction of our plant. This method of introducing our product reaped good results, in that the first day we were ready for operation there was business on hand for delivery. We did not stop here with our advertising, but had pictures of our plant published in the local building trade publications. In the one which has the most complete circulation in this territory, we published a twelve-page supplement which fully described our plant, our methods of transportation, and the advantages and disadvantages in its use. Whenever we supplied a job under unusual conditions, we solicited the assistance of the local newspaper in presenting the facts to the public.



Ready-mixed concrete plant operated by the Avril Tru-Batch Concrete Co. at Cincinnati, Ohio

For example, in the winter of 1929, one of the large contractors had contracted for a big city garage. Construction was begun in January and it was necessary to complete the job within 90 days after signing the contract. Ground conditions and winter weather were so severe that, had the contractor mixed the concrete on the job, not only would his costs have been considerably in excess of the bid price, but the delays in concrete work would have made it necessary to exceed the time limit. Hot, ready-mixed concrete was delivered to the job from our plant, which permitted the use of a very small crew of laborers, and the contractor experienced no difficulties in getting the concrete placed well within the specified time.

Delivering ready-mixed concrete right to the job



Heating plant for the batching bins

Aside from the paid advertising, we have found our trucks, because of their unusual appearance, to be our best advertisers. They are not only responsible for a large amount of unsolicited business coming to us, but have created enough interest to make an introduction superfluous when calling on a contractor. In selling a job now, it is seldom necessary to discuss in detail the advantages and disadvantages in the use of ready-mixed concrete. The contractors all seem to be fairly well posted. The greatest amount of sales resistance we now meet lies in the fact that all the good contractors in town own a large amount of mixer equipment, and until this is worn out, we cannot hope to pour but a small percentage of the concrete used in Cincinnati. This condition, however, is gradually working itself out.

Factors in Volume of Output

We know that central mixing plants in other cities, comparable to Cincinnati in size, are producing considerably more concrete on a yearly basis than we are. There are several factors contributing to this. Some of the other plants are so connected politically as to insure them of a large production, and some of them have more trucks in operation than we have. Our problem has been to keep the plant at a production which would enable us to work our trucks full time without increasing our fleet too rapidly. We believe it better to hold our production steady, with fewer trucks, rather than have exceptionally high peak days, intermingled with unusually poor ones. From the accompanying graphs the reader will notice the uniformity of the yardage produced at the plant during the past season. In accomplishing this, we had to be very careful in choosing the jobs we wanted to supply. We made a special effort to obtain as much work within a radius of three miles of our plant as possible.

Sale Resistance and How to Overcome It

In selling ready-mixed concrete, there are a number of obstacles which must be overcome. The old, time-worn question of how concrete can be transported without setting up, is almost invariably the first one we have to answer. The answer which has proved convincing is that concrete which has been kept in constant agitation during transportation will neither set up nor segregate. A reference is made to the standard specifications on the initial set of portland cement, which, as you know, is in the neighborhood of three hours. We also tell them about some research work conducted by the Portland Cement Association, in which they

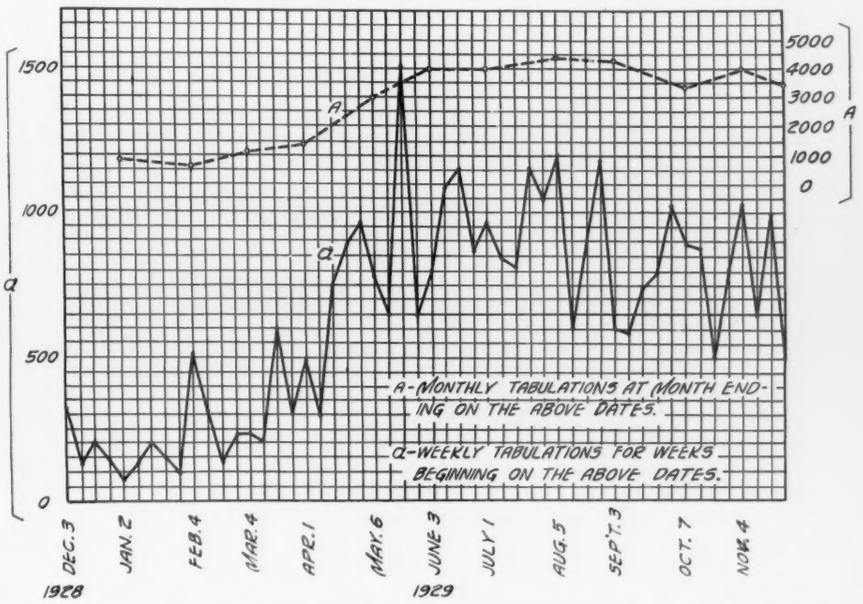
County bridge under construction using ready-mixed concrete

have found that concrete can be retempered at periods of from one to six hours, provided it is kept in an air-tight container, before placing in forms without materially altering the strength of the concrete structure. The architect, who brings up the argument that his specifications require all concrete to be placed in the forms one-half hour after mixing, has been convinced that concrete, discharged from our agitator trucks, is in as good if not better condition than that discharged directly from the mixer to the forms.

Another objection, which some contractors try to make themselves believe, is that mixing on the job is superior to ready-mixed concrete because we cannot compete with their costs. To combat this, we have fortified ourselves with actual costs experienced by some of the leading contractors for placing and mixing concrete on the job, and compared them to the costs of using ready-mixed concrete under similar conditions. We admit that, under some conditions, concrete could be mixed on the job cheaper than we could deliver our product. These conditions, however, are rare, provided the user takes into consideration all branches of the job which are affected where ready-mixed concrete is used.

In a building job, using approximately 5000 cu. yd., we learned from the superintendent that he was saving about 75 cents per cu. yd. on clean-up costs alone. This was due to his not having to employ a large concrete gang which would be doing nothing but odd jobs of cleaning up at all times when concrete was not being poured. He also liked our service in that he was able to keep a small, efficient crew busy at all times, rather than have to find work for a large, comparatively inefficient gang. All of these things contribute to maintain low costs on the different branches of construction. It is easy to see that if a superintendent does not have to spend a large part of his time with the concrete crew, he is in a much better position to watch costs on the rest of the job.

A very important factor which contributes to the success of a ready-mixed concrete plant is that through careful control of the mix, and the ideal proportioning of coarse and fine aggregates, there is a minimum amount of honey-comb resulting on the job. Because of this, quite a saving is made in the pointing up costs. Since most of the contractors use patented shores, it is important that these be wrecked as quickly as possible after the concrete is poured. Shores can be wrecked from under a slab in one week for which a mix is designed to give not less than 3000 lb. per sq. in., in 28 days. It is easy to show a saving here because, as you know, the usual specified time for shores to remain under slabs is not less than two weeks. The saving of a week's shore rental on each slab pour alone is quite a sum. In conjunction with this, however, a job can be kept going at full speed with much less form lumber, because as soon as the shores are wrecked the lumber can be used again. There are so many small items which do not appear on the surface, but which are instrumental in saving the contractor money, that this article would be far from readable should I attempt to cover them.



Production chart, tabulated weekly and monthly, of the Avril plant

Six Factors in Success

Six major factors contribute to the successful operation of a central mixing plant.

1. Deliveries must be made at the time specified and on a precise schedule.

2. The concrete must be discharged from the trucks in good workable condition and it must be of a proper, uniform consistency to insure a perfectly smooth, dense structure if carefully placed.

3. The batching and mixing of the concrete must be done under accurate plant control.

4. The different mixes must be designed in accordance with intelligent, scientific procedure, combined with practical experience.

5. The plant should be designed to need very few men in its operation.

6. An efficient heating plant is an absolute necessity for winter business.

The first requirement in properly dispatching trucks is a man of more than average intelligence, who, under pressure, can perform his duties coolly and accurately. He has free reign in his work and is held responsible for keeping the men on the job satisfied, and for giving the man who does the batching and mixing proper instructions as to the mix and consistency of each batch. He uses a simple system of delivery records, which can be easily followed. If they are kept properly, all jobs can be served at the correct intervals, provided the business booked for one day does not exceed the delivery facilities. The control of the day's business is in his hands, because all orders for delivery are given to him direct from the job by phone. No delivery instructions are taken by anyone else without first consulting him. In his telephone conversation he is instructed to be pleasant and courteous at all times and to obtain all possible information about job conditions, rate of delivery, and everything else which may intelligently help him give good service.

All this can be summed up in the one word—*service*. Without a doubt, it is the keystone to the business. Every effort should be made to co-operate with the contractor at any and all times. We try to impress our men that they are not only working for us, but are a very important link in the job organization. The position of a ready-mixed concrete organization is comparable in one way to that of an actor. With him, it is "on with the show," regardless of grim death and starvation, and the battle-cry of the ready-mixed concrete operator is "Service at any cost."

We had an interesting experience recently, which exemplifies this statement. On a large interceptor sewer, which incidentally is the first large contract let in conjunction with the new $75,000,000 railway terminal in Cincinnati, the contractor unfortunately met with the difficulty of high water. The water was rising at the rate of about one inch an hour. All of his forms were in place and if he had not acted quickly, would have been washed out completely. It was up to us to help him. We started pouring about 2 o'clock in the afternoon, and continued throughout the night. Everyone was keyed up to a high pitch. Both the contractor's

organization and ours worked 30 hours continuously to complete the job. The water conditions were so bad that the contractor had to discontinue any further work until the water receded. By working with him in this way we not only saved him money, but gained an unlimited amount of his good will.

Records

The following illustrations show the type of records our traffic manager keeps. The delivery slips contain all the necessary information about job location, mix and time of delivery. These are made out in triplicate. The schedule used has a column for each job, which is subdivided into three divisions, one for the truck number, one for the time the truck leaves the plant and one for the time of its return. By referring to these records, it is very easy to anticipate the exact time each truck will return to the plant. Knowing the normal time required to make a delivery to a certain location, he can tell from his records whether or not the truck is being delayed. If a truck does not return within a reasonable time, he immediately gets in touch with the job to ascertain the reason for the delay.

Date _____, 192—

Avril Tru-Batch Concrete, Inc.
DAILY JOB SHEET

Ticket No.	JOB Truck	Left	Back	JOB Truck	Left	Back	JOB Truck	Left	Back	JOB Truck	Left	Back	JOB Truck	Left	Back	JOB Truck	Left	Back	JOB Truck	Left	Back	JOB Truck	Left	Back	JOB Truck	Left	Back	JOB Truck	Left	Back

Data taken from the delivery slips are recorded on this form to give the traffic manager a complete check on deliveries and trucks

To deliver concrete to the job in good workable condition, it must be kept agitated while in transit. This is accomplished at our plant with a patented agitator body. It is a totally enclosed type. The cylindrical container, which revolves, is mounted transversely on the truck chassis. This plan of mounting permits the use of one opening for both charging and discharging. It is in the loading position when the opening is the top, and in the discharging position when the opening is to the rear. The transverse mounting is used to eliminate the necessity of an underbody hoist. This body operates efficiently in hauling concrete of from 2 to 10-in. slump for distances of 20 miles or more. Should the truck be delayed the body can be revolved to give the batch constant agitation. It absolutely eliminates the possibility of segregation, regardless of the consistency of the concrete. A very desirable feature of this body is that it has a large opening which permits quick charging and discharging.

ORDER

Avril Tru-Batch Concrete, Inc.
Este Ave. and B. & O. Railroad
(Winton Place)
Cincinnati, Ohio Phone Kirby 4594

Order No. _____
Date _____, 19__
Terms _____

Charge to _____

Deliver to _____

_____ Cubic Yards Concrete
Mix _____
Slump _____
Lbs. Comp. _____
Price Quoted $ _____ per Cubic Yard
Delivery Schedule _____ Cubic Yards per Hour beginning _____
Signed _____

Accepted By _____

The order blank gives all the information regarding the particular job

Aggregate Control

In maintaining accurate control of the mixes, our first move was to see that the aggregate producer gave us properly graded materials. We insisted that he arrange his product so that we could be reasonably sure that we get a coarse aggregate, having a fineness-modulus of approximately 7.5, and a fine aggregate, having a fineness-modulus of from 3 to 3¼. By combining these two in the proper proportions, we find that an ideally workable mix, designed to give a definite strength, can be produced economically. The materials are stored in bins, which tend to keep the moisture content uniform and practically eliminate segregation. We are reasonably sure of the uniform density in our aggregate, because we are so equipped as to maintain the gradation uniform. All materials are batched by weight, which assures accurate proportion. The moisture content of the aggregate is checked at regular intervals, and the water added is measured in an accurately calibrated tank, which can be set for any desired quantity, and will discharge only that amount unless reset.

To explain in detail our methods of designing mixes would be rather involved. Our procedure in a general way is as follows: We determine the gradation, the specific gravity and the dry rodded weights per cubic foot of the aggregate. This data is combined with Abrams "water-cement ratio theory" in conjunction with partial trial methods. Our results have been fairly uniform and accurate. Over a period of five or six months, concrete designed to give a definite strength has varied only a few hundred pounds. This can be seen in the test reports given on p. 161 on 3000-lb. design mixes. These are the results of tests made by the H. C. Nutting Co., testing laboratories. The tests were made on concrete we delivered to a new factory building requiring 5000 cu. yd. The job is now about 75% complete. Each of the following results represents a major pour of concrete designed to give a compressive strength of 3000 lb. per sq. in.

CUSTOMER'S COPY
PHONE KIRBY 4594
AVRIL TRU-BATCH CONCRETE, Inc.
MANUFACTURERS OF PRE-MIXED CONCRETE
ESTE AVE. & B. & O. RAILROAD
WINTON PLACE
CINCINNATI, O.

Date _____
Contractor _____
Deliver to _____
Truck No. _____ Order No. _____
Yards _____ Strength _____
Mix _____ Slump _____
Class of Work _____ Aggregate _____
Leave Plant _____ Arrive Job _____
Leave Job _____ Arrive Plant _____
Inspected by _____
Signed _____
No. 18315

Facsimile of the delivery slip—customer's copy

OFFICE COPY PHONE KIRBY 4594
AVRIL TRU-BATCH CONCRETE, Inc.
MANUFACTURERS OF PRE-MIXED CONCRETE
ESTE AVE. & B. & O. RAILROAD
WINTON PLACE
CINCINNATI, O.

Date _____
Contractor _____
Deliver to _____
Truck No. _____ Order No. _____
Yards _____ Strength _____
Mix _____ Slump _____
Class of Work _____ Aggregate _____
Leave Plant _____ Arrive Job _____
Leave Job _____ Arrive Plant _____
Inspected by _____
Signed _____
No. 18315

The office copy—triplicate of the delivery slip—is part of the office record

with a 6 to 8-in. slump in 28 days.

Date	7-day strength lb./sq. in.	28-day strength lb./sq. in.
7- 3-29	.....	3143
7- 8-29	1981	.....
7-17-29	1983	.....
7-19-29	1987	.....
7-26-29	1928	.....
7-29-29	1770	3559
	1723	.....
	1719	.....
8- 8-29	.....	3394
	.....	3431
8-15-29	.....	3194
10-16-29	2116	.....
10-17-20	1929	.....
10-21-29	2044	.....
11- 6-29	.....	3116
11- 7-29	.....	2973
11-11-29	.....	3607
11-14-29	1811	.....
11-15-29	1957	.....
11-18-29	1969	.....
11-22-29	.....	3573
11-26-29	.....	3474
11-29-29	1938	.....

On this particular job the contractor and ourselves were more interested in getting a 7-day strength of about 1800 to 2000 lb. per sq. in., because it permitted him to wreck shores in seven days. You will notice that some of the 28-day strengths are considerably higher than is required. This is due to the use of several different brands of cement at different times.

Man Power—Handling Frozen Aggregate

In our operation, we need two men to handle aggregates, one man to unload cement, one on the batching platform, one to route trucks and a plant foreman, who takes care of all the mechanical work. In our winter operations, in addition to these men, we need two firemen, one for the day and one for the night shift. Material handling, batching, mixing and delivery units are so co-ordinated as to all be of the same capacity.

Because of the erratic weather in Cincinnati, it is necessary to equip our plant with a complete heating system. It is not unusual for us to experience three or four days of very wet weather, followed by three or four days of extremely cold weather. Because of this, sand and gravel shipments cannot be regulated to avoid badly frozen cars. We are combating this situation with a steam line underground, to which we connected two steam hose opposite each car. The free end of the hose is attached to a 6-ft. section of 1½-in. pipe, which is pointed and perforated at the bottom end. This device is driven into the sand or gravel from the top. In this way, live steam is injected into the mass. There are two of these pipes for each car. By changing their location at intervals of one-half hour, it is possible for us to thaw a 70-ton car in about three hours. We have installed enough steam jets to thaw out four cars at one time. By using this system, we can easily supply materials to the mixer for a production of 200 cu. yd. per day under the most extreme weather conditions. This method raises the temperature of the aggregate so there is little chance of the material freezing in the conveying and elevating equipment. The reserve storage is heated by perforated steam pipes placed advantageously in the bins.

Instead of using live steam in the batching bins, we have completely lined them with coils. In this way we have a uniform heat distribution and also hold the moisture content in the aggregate low. Aside from heating the materials throughout, we also heat the water to a temperature of about 150 deg. F. This is accomplished by injecting live steam into a 700-gal. enclosed water tank.

The heat in our batching bins and water heater is supplied by a 25-hp. vertical fire-tube boiler. That required to thaw cars and take care of reserve storage is a 20-hp. boiler of the same type.

Since the ready-mixed concrete industry is in its infancy, it is probable that the plant we now have will be almost obsolete in the next few years. We have attempted, however, to visualize future developments in concrete construction and have designed our plant accordingly. All of the units help in delivering a uniform, well designed and well mixed product, suitable for all classes of construction, both in summer and winter.

The contractors in Cincinnati are realizing more each day that there is a definite need for ready-mixed concrete in their work. It is not only being well received, but has reached the point where job superintendents are asking for it and the writer has had the pleasant experience of having these men suggest sales arguments. They have voluntarily offered information as to the savings experienced on their jobs. It has been the aim of our organization to give the contractor more than could possibly be attained by mixing the concrete on the job.

WEEKLY TRUCK MAINTENANCE REPORT WEEK BEGINNING_____

PARTS	OIL and GREASE	REPAIRS	COST
Engine			
Magneto and Spark Plugs			
Carburetor			
Water Pump			
Transmission and Rear End			
Clutch and Universal Joints			
Springs			
Steering Gear			
Wheel Bearings and other Bearings			
Storage Battery			
Brakes			
Speed Reducer			
Power Takeoff			
Chain			
Cab and Body			
Tires			
TOTAL:			

Front side of the truck maintenance form

	Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
GAS—							
OIL—							
GREASE—							
MILEAGE—							
TIME—							

Remarks:

Driver .....

Truck No. .....

Reverse side of the maintenance form gives a daily record

Cement Products

Cement Products Industry Builds Constructively During 1929

CONSTRUCTIVE progress during 1929 gives the cement products industry an encouraging outlook for 1930.

Since the early days of the old concrete block business constructive salesmanship and modern advertising methods have dragged far behind the possibilities of the products. For many years problems of insuring quality, fixing dependable standards, improving manufacturing methods and equipment and insuring recognition in building and insurance codes properly absorbed the principal attention of the industry. All of this work formed a logical preparation for more progressive methods in selling. During 1929 selling received greater attention than ever before.

The concrete masonry manufacturers—those making concrete block, tile and brick—are slightly less numerous but their capacity to produce is slightly greater than for last year, according to reliable estimates. However, the actual output of concrete building units during 1929 was approximately the same, or perhaps only slightly greater, than in 1928. The Portland Cement Association and the Concrete Products Association have estimated the output at the equivalent of 350,000,000, 8 in. by in. by 16 in. units during 1927, 384,000,000 units for 1928 and nearly 400,000,000 units during 1929.

Still More Sales Effort Needed

Manufacturers of concrete building units have at last recognized generally the need for more and better selling effort by each individual manufacturing organization. It is estimated that approximately 450 paid salesmen are now employed by the manufacturers in a field where two years ago there were hardly more than one-tenth that number. The crying need is still for more and better salesmen and it is not unlikely that 1500 salesmen could be profitably employed during the coming season.

The importance of high class, well informed salesmen is so great that the Portland Cement Association organized and conducted 62 sales schools or conferences in convenient centers during 1929. Largely in response to requests, an even greater number are to be given during 1930, with prospects that this work will become almost a permanent feature. Some very effective technical sales material is being supplied to the manufacturers and salesmen through these meetings.

Eighteen new concrete masonry house plans, prepared by the Architects' Small House Service Bureau, appeared during the year in 85 leading newspapers throughout the United States, embracing a wide range of attractive designs in houses of small or moderate size. These plans reached homes with an estimated 4,500,000 readers. Many of the concrete masonry manufacturers advertised on pages containing these plans and several hundred inquiries were obtained.

Light-Weight Aggregates Gain

Considerable progress has been made recently in the development and introduction of light-weight aggregates. Reports from the East indicate that fully 100,000,000 cinder blocks, or one-quarter of the entire block output, were manufactured in 1929. This is a large and encouraging increase for cinder aggregate block producers. Haydite, the light-weight, burnt-clay aggregate, has also made excellent progress, although the cost of the aggregate is so much greater than that of cinders that expense is a somewhat deterrent factor. Several other light-weight materials, produced mostly by process-burning clay particles, have been proposed and a few already have a modest production.

From a production of 40,000 cu. yd. in 1927, Haydite jumped to an output of 325,000 cu. yd. in 1929. In New York City efforts are being made to produce a light-weight aggregate of acceptable qualities by reducing household ashes through a sintering process. Ceramics departments of several state colleges contemplate experimental work to find effective methods of producing concrete aggregates through the burning of various clays and shales. This activity indicates a general interest in the development of light-weight aggregates which would be very helpful in their further development.

The rapid progress being made by cinder concrete units for both load bearing and partition purposes is based largely on many advantageous qualities not shared by substitute materials. Fortunately, cinders of acceptable quality are quite widely available at low cost. Lightness of weight, nailability, "cutability," soundproofness, heat insulation and fireproofness are contained to a degree which makes these units particularly desirable in high commercial and public structures, a field not previously reached by ordinary aggregate concrete units.

Recent examples of the recognized suitability and economy of this material in these fields are more numerous than at any time in the past. Cinder concrete block were used extensively in the new Haddon Hall Hotel at Atlantic City, 600,000 units, the equivalent of 7,200,000 brick, having been sold for this purpose. In Philadelphia four tall office buildings have been constructed during the year using cinder concrete block very extensively throughout and examples of the extensive use of concrete block in large structures of various kinds come to hand with greater frequency than heretofore.

Recognition of Fireproof Qualities

Discrimination against concrete block and tile in insurance rates, which only a few years ago offered one of the greatest handicaps to concrete products sales, has disappeared very generally, coincidental with fixing of quality standards and the production over the country of dependable and more nearly uniform material. Some of the insurance engineers, after studying production methods, have made constructive suggestions of great value to the industry. Forty-three states accord concrete masonry the same rates as solid brick walls in dwellings and in forty-one states concrete masonry bearing the underwriters' label, receives a rate lower than clay tile in commercial buildings.

A considerable number of the concrete products manufacturers have subscribed to the Underwriters' label service calling for frequent inspection of their products by engineers of the Underwriters' Laboratories

and conferring the right to affix the prescribed label. The advertising value of the label is excellent and the number of subscribers to this service should continue to increase. The label not only carries a preferred insurance rate but it is really an additional quality guarantee to purchasers. Fire test studies of concrete block made of various aggregates and mixtures continue in the laboratories of the Portland Cement Association, throwing much new light on the behavior of these units under severe fire conditions.

To Reach Home Builders

The market for dwellings is being reached by advertising more extensively than in the past. Prospective home-owner purchasers of concrete building materials are far too numerous to be reached by personal call, without involving greater expense than can be justified. The national periodicals are carrying a modest amount of advertising featuring fire-safety in dwelling construction by means of the successful use of concrete masonry walls, reinforced concrete floors and concrete tile or cement asbestos shingle roofs. Many concrete products manufacturers are advertising locally on quite an extensive scale, giving the general advertising noted above a local "tie up." This advertising is all much better than previous copy, being illustrated with photographs of houses of good architectural design and distinguished appearance. These advertisements indicate that there is noticeably more pride than formerly taken by the local manufacturer in his business and in the uses to which his products are put.

Manhole Block

Circumferential concrete block have found a steadily growing market, for use in manhole, catch-basin and cistern construction. These blocks permit a large saving in labor in the erection of almost any type of short-radius circular construction. Although manufacture of these circumferential block were limited almost entirely to the Chicago metropolitan areas until last year, nearly 100 manufacturers are now making them regularly, serving the demands in almost all parts of the country.

Concrete Stave Silos

The year 1929 was perhaps the greatest in point of volume of business ever done in the concrete silo field, being probably 15% ahead of 1928. Although the number of manufacturers in this field has declined steadily, output per plant has increased more than in proportion. A few years ago relatively few manufacturers produced more than a score of silos per year. These manufacturers were located in agricultural centers for the greater part and produced silos for farm purposes almost exclusively. Last year one manufacturer manufactured and erected about 1000 silos and several others produced between 100 and 600 each, while the entire output is estimated at approximately 10,000 silos. Many of these are being used for the storage of coal, grain and stone, somewhat more than half going onto the farms for the storage of corn silage. The credit situation is noticeably better in the farm silo field and the outlook good for increased sales in 1930.

Lighting Standards

Important progress has been made during the past year in both the manufacture and the promotion of concrete lighting standards. Early manufacture of these reinforced lighting posts had not been entirely successful due to defects of design, concrete mixture and plant methods. As a result, a determined reaction developed against the use of concrete lighting standards. Fostered by manufacturers of other types and based on a number of actual defects, the reactions were acute and resulted in the loss of a large amount of business.

This situation led to a careful study and a general revision of manufacturing practice. Star and "x" shaped designs disappeared in favor of the octagonal, 12-sided and circular sections offering greater protection to reinforcing metal and greater immunity from shrinkage cracks. Denser mixtures and a more general employment of the centrifugal method of manufacture is noticed. Greater cars is being taken in mechanical handling of the standards in process, in curing and finish, with the result that during the past year this product has regained lost ground and made greater progress than at any time during the past.

During the year a consolidation was effected of the Marbleite Corp., the American Concrete Products Co. and the Chicago Concrete Post Co. under the name of the Marbleite Corporation of America, placing in the field a national manufacturing and sales organization. In the Chicago areas alone many thousands of posts were erected during 1929. River Forest, Forest Park, Berwyn, Cicero and several of the North Shore suburbs have installed complete lighting systems employing concrete posts or installations of considerable size.

Cast Stone

Manufacturers of natural building stone have stiffened their competition quite noticeably, apparently feeling alarmed at the inroads made by the manufactured material. In many cases the public has received considerable benefit in the way of price reductions on natural stone.

An attempt is being made by producers of natural building stone to prevent the use of the term "cast stone" on the grounds that it is deceptive to purchasers and improperly appropriates the name of the natural product. Irrespective of the merits of the case, cast stone is receiving considerable advertising benefit from the commotion caused by placing the matter before the Federal Trade Commission. Regardless of the decision of the commission, if one be formally rendered, the public will continue to know what is meant by "cast stone," "concrete architectural stone" and similar terms and the material will continue to gain in popularity according to its merits and the wisdom shown in promoting and selling it.

A long step in advance was taken in the adoption by the American Concrete Institute of tentative standard specifications for cast stone. In the past this material has been purchased largely on visual inspection of samples in much the same manner as the practice with natural stone. The new specifications will not only safeguard purchasers against inferior quality but the tests provided for will demonstrate to the public several of the important points of superiority which might otherwise escape unnoticed.

The Cast Stone Institute, organized in 1928, gives promise of assisting materially in the research and development work of the cast stone industry. The Institute is conducting a splendid advertising campaign among architects and users and is actively at work on further plans for making known the merits as well as researching technical problems in connection with cast stone manufacturers.

The year's volume of cast stone business was generally reported to be satisfactory although considerably below the capacity of the leading factories.

Portland Cement Stucco

Notwithstanding the most attractive booklets, most concise and practical information on its manufacture and application and a variety of splendid new textures, portland cement stucco has made relatively slow progress during 1929.

This situation is generally attributed to the public dislike of all stucco as a result of generally unsatisfactory experience during the last few years with a number of competitive products, practically all of which are said to be off the market at present.

Safeguarding future users of portland cement stucco, the American Concrete Institute recently passed tentative standard specifications for finish coats, fixing a quality that can be definitely depended upon. During the year the Portland Cement Association completed important laboratory studies on stucco and issued a circular of recommended practice for its manufacture. This information is very comprehensive, including plant layout and suggestions of various kinds for manufacturers.

The association also prepared a "Plasterer's Stucco Manual" describing the essentials for good stucco construction and much information regarding artistic modern textures. This manual has been carefully distributed to about 40,000 plasterers in order to spread helpful knowledge on the subject to the craftsmen as rapidly as possible.

The Coming Year

It is expected from current estimates that general building of the character which absorbs concrete block, brick, tile, roofing and partition will show some shrinkage, if these are accurate, sales of these products must suffer accordingly, except as they replace other products. The general feeling among leaders of the industry is that they are not competing so much with other materials commonly used for the same purposes as they are with automobiles, radios and other items which have cut a deep slash in the percentage of the public's dollar which goes for building.

President Hoover's move to stimulate building is likely to prevent any further shrinkage and may produce an increase although it will probably be most effective with public and other large construction undertakings in which concrete products figure only in a very minor way. Easier money and reasonable interest rates are expected to have beneficial effects but to what extent and how soon is, of course, problematical.

Cement Products Incorporations in 1929

THE following list of incorporations is by no means complete and represents only those that were reported to ROCK PRODUCTS during the past year. The listings will give the reader an idea as to the locations of the larger centers of activity in that industry:

State		Total No.	Number listed as of no par value	Capitalization*
Alabama		2	1	$ 10,000
Colorado		1	1	.....
Connecticut		4	..	195,000
District of Columbia		1	..	50,000
Delaware		6	1	2,200,000
Florida		2	1	6,000
Illinois		10	4	185,000
Kansas		2	..	40,000
Kentucky		2	..	27,000
Maryland		2	..	25,000
Massachusetts		3	1	35,000
Michigan		2	..	60,000
Minnesota		1	..	200,000
Missouri		2	..	250,000
New Jersey		12	3	487,000
New York		10	3	1,510,000
North Carolina		3	..	210,000
Ohio		2	..	120,000
Oklahoma		3	..	90,000
Pennsylvania		3	..	80,000
Rhode Island		1	1	.....
South Carolina		1	..	5,000
Tennessee		1	..	25,000
Texas		10	5	186,000
Washington		4	..	40,000
West Virginia		1	..	10,000
Wisconsin		5	1	125,000
Total	1929	96	22	$5,271,000
	1928	98	28	$3,508,500
	1927	128	....	$10,878,250
Canada:				
	1928	8	2	399,000
	1929	4	2	400,000

*Total of stocks listed with par value.

"Colorcrete"

THE Cement Marketing Co., Ltd., of Portland House, Tothill street, London, has been experimenting for some time with the object of producing a colored cement which, while possessing all the advantages of "Ferrocrete," the rapid hardening portland cement, could be marketed at a price to enable architects, engineers, surveyors, builders and others interested in constructional work to vary the color of concrete at a negligible additional cost. The result of these experiments is now embodied in the new cement which they are placing on the market under the registered title of "Colorcrete."

Although "Colorcrete" cement is a buff color, the resultant concrete made with it has a pinkish tint. A red "Colorcrete" can also be supplied.

The advantages to be obtained from the use of "Colorcrete" are claimed to be threefold, viz.:—(1) It produces a concrete of a neutral and pleasing tone; (2) it is guaranteed to be equal to "Ferrocrete" in quality; and (3) the price will enable it to be used for ordinary purposes.

Typical examples of concrete work for which "Colorcrete" can be used are as follow:—"Colorcrete" will enable the carriageway of private streets to be laid so that it has the appearance of well-consolidated gravel, in most cases at a price which will compete most favorably with any other permanent form of construction. When used for general concrete work, such as garage approaches, footpaths, crazy paving and surrounds to houses, it will enhance the appearance and value of the property, and, in addition, it can be used to give a pleasing effect to stucco. It should appeal to architects and designers of concrete buildings, where it is desired to vary the effect of ordinary portland cement concrete at very little extra cost. For seaside work generally "Colorcrete" should be particularly useful where it is desired to depart from white or grey. Where a particular shade of reconstructed stone is required, "Colorcrete" should enable manufacturers to reduce their costs.

The firm says:—Wherever it is desired to depart from the natural grey color of concrete, except for work where delicate tints of particular shades are required (which can be secured by the use of colors mixed with "Snowcrete"), "Colorcrete" will give a warm-toned concrete at a reasonable cost. The best effect from "Colorcrete" is obtained by removing the surface skin of neat cement, which in most cases can quite easily be done either by the use of a stiff broom before the concrete has hardened, or, in the case of concrete buildings or walls, "Retardo" can be applied to the shuttering to enable the surface skin to be brushed off quite easily on the removal of the shuttering.

The use of aggregates of various colors will, of course, give different effects, but the ordinary gravel and sand commonly used give a very pleasing appearance when mixed with "Colorcrete," which is intended to be sold and used for general utility purposes, and not to be limited to work of a particular style or character.—*Contract Journal* (London, England).

Fire Exposure Tests on Hollow Concrete Units

MOST concrete products manufacturers know that concrete masonry is the only hollow masonry that has received official rating as a standard fire retardant material. An extract from the Underwriters' Laboratories Retardant Report No. 1555, giving the results of fire exposure tests upon hollow concrete masonry units, states:

"Walls composed of these units do not add fuel to fire. From the fire protection point of view their use is to be preferred over walls of combustible material or of non-combustible material, the strength of which is seriously affected by fire temperatures."

A fire demonstration house at Birmingham, Ala., burned for 50 minutes, after which water under pressure was applied to the interior walls, they being then in white hot condition. The state fire marshal of Alabama, who attended the demonstration, reported:

"On inspection of the building, no cracks of any nature were found, nor was any disintegration or crumbling of the tile apparent. The ceiling was undamaged and the concrete tile roof showed no evidence of having been affected. These units plainly demonstrated their fire resisting qualities and are to be highly recommended for use in the construction of permanent, fireproof structures."

Similar demonstrations and tests in other sections have shown identical results.

West Virginia Geological Survey

THE DETAILED county geologic report of Pocahontas county, West Virginia, has been published by the West Virginia Geological Survey. This book, by Paul H. Price, assistant geologist, contains a short chapter on historical and industrial development, a chapter on physiography, nine chapters on geologic history, structure and stratigraphy, as well as other chapters dealing with the state's mineral resources, paleontology, etc.

In a separate atlas, maps Nos. 1 and 2, respectively, show the topography and geology of the county. On these maps the topographic base is assembled and photolithographed from the standard topographic quadrangles as surveyed and published by the United States Geological Survey in cooperation with the West Virginia Geological Survey, with certain cultural corrections added by the author. On this corrected base the geologic map was drawn.

This report may be obtained from the West Virginia Geological Survey, Morgantown, W. Va., for $3.00.

New Machinery Developments in 1929

SPECIFICATION writers and enforcers kept many machinery makers busy in 1929 and probably will continue to make work for them for several years to come. Constantly growing demands for cement of one or more special properties; for clean, carefully segregated and uniformly segregated aggregates; for more finely ground limestone and phosphate rock, etc., have caused producers to make large investments in new and improved machinery and equipment, even in a year when production was falling off. Thus some large machinery manufacturers serving the rock products industry reported the most business and the largest profits in their history.

Explosives and Accessories

The more recent addition to du Pont products is a powerful new blasting machine. This was designed by research engineers of the General Motors Corp., after they had examined and tested nearly every type of existing machine. A special study was made of the merits of shunt wound and compound wound dynamos, but after exhaustive tests the original winding in series was adopted, with a number of modifications for which patent application has been made.

Among the new electrical features of this machine are a two-point clutch which enables the current to be sent out on the firing line at its peak; a laminated armature and solid-core field for building up the maximum current; a one micro farad condenser to store up the current until the moment of discharge; and most important of all, a new eight-point breaker of unique design which utilizes the current heretofore wasted in the large spark at the completion of the stroke.

The mechanical improvements consist of the field windings being placed so as to improve the efficiency of the machine; ball bearings on the armature shaft; and a thrust bearing for the rack bar in the direct line of thrust instead of being offset as formerly.

The machine has a rated capacity of 100 caps, but this rating is claimed to be very conservative as one cap has been fired through a resistance of 550 ohms and 15 caps have been fired in parallel. It has been exhaustively tested in the field and on numerous occasions has fired as many as 125 holes connected in series.

The assembled machine weighs a little less than 36 lb., being only a trifle larger than the old du Pont No. 3, 30-hole machine, although it is stronger than the No. 5 or No. 6.

Quarries and mines where rotation firing is practiced will be interested in improvements which have been made in du Pont "delay electric blasting caps." The delay caps now being manufactured by this company are so much smaller in diameter and so much shorter than the old type that it is claimed to be easy to prime a cartridge with even the tenth delay. The shell is entirely of metal, providing much better protection against moisture than did the old rubber covering which was likely to become oxidized in long storage and to crack. The new delay electric detonators show very little tendency to ignite the dynamite charge, and finally the caps of any one delay come much nearer firing at the same instant than did those of the old type, thus practically eliminating the chance that any of the holes in a round will fire out of turn.

Some of the du Pont explosives which are extensively employed in mining and quarrying the various nonmetallic minerals have also been improved during the past year. A slight change has been made in the formula of the du Pont "Extras" which renders them more cohesive. This means that these low density ammonia dynamites which have proved very economical in some operations will now stick better in upward pointing bore holes and can, therefore, be employed more satisfactorily than heretofore in mines where the system of blasting requires a large number of uppers. This change in the formula of the du Pont Extras also increases their water resistance to a small degree.

Red Cross Extras have been greatly improved in respect to fumes. In fact, this brand of dynamite as now manufactured is said to be comparable with the present du Pont gelatins in regard to volume of poisonous gases given off upon detonations. Furthermore, in the near future a change will be made in the manufacture of du Pont gelatins so that obnoxious fumes from them will be considerably decreased below what has long been considered the irreducible minimum. As a result of the improvement in the fumes of these explosives, Red Cross Extra can now be used in numerous underground operations where an ammonia dynamite will give satisfactory execution at a lower cost than gelatin, but has been previously undesirable on account of fumes; and in mines where gelatin is still most efficient, the men will be able to return to the face with safety and comfort in a much shorter time after the shots are fired.

During the year the Hercules Powder Co. developed a new pocket size blasting machine (Rock Products, April 13) and a new type of explosive "Hercoal-C" for use in coal mines (Rock Products, July 20). This company has also just announced recent developments in blasting machine design, practically eliminating the necessity for oiling the bearings. The 1 to 50-hole blasting machines have been equipped with an armature shaft of special porous bronze, impregnated with graphite. During assembly a little oil is put on this shaft, and thereafter for the life of the machine the shaft bearing is self-lubricating. Troublesome oil cups have been eliminated, and the only oil now necessary to the blasting machine is a very small quantity occasionally applied externally to the rack bar, it is claimed.

An outstanding development in explosives was the erection of a liquid oxygen plant (L. O. X.) at the quarry of the Dolese and Shepard Co., near Chicago, by the Loxite Co. (Rock Products, April 13),and the extending use of this explosive by nearby quarries. The strip-mine operators in the coal industry, where under present conditions every possible economy is of importance, have adopted L. O. X more extensively than quarry operators. For example, the most recent Loxite plant installed by the Keith Dunham Co. is for the United Electric Coal Co.'s Fidelity mine at Duquoin, Ill., where all the blasting of overburden is done with Loxite.

Drills and Drilling Accessories

IMPROVEMENTS were made in all types of rock drills. The Black and Decker Co., Towson, Md., developed a new small electric hammer claimed to strike 2300 blows per minute (Rock Products, January 5). The Chicago Pneumatic Tool Co. introduced its CP-146 stoper drill with air-operated feed control and various special features (Rock Products, June 22). The Gardner-Denver Co. produced a new lightweight pneumatic drill (of about 50 lb. weight) for ⅞- to 1-in steel (Rock Products, September 14). The Gilman Manufacturing Co. placed on the market an elec-

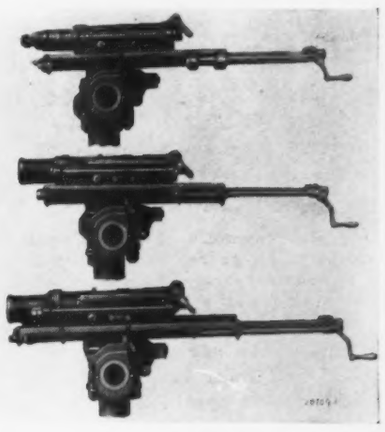
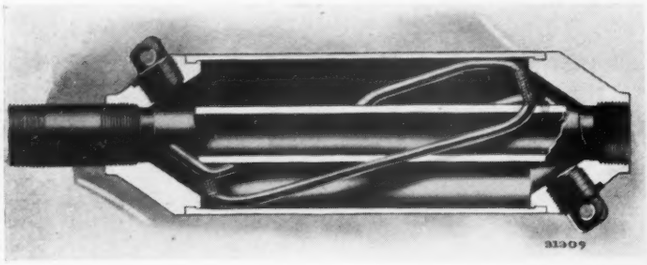


Fig. 1. Three sizes of wet drifter drills



Left—Fig. 2. A new air-line lubricator. Right—Fig. 5. Core drill for prospecting limestone depths from 50 to 250 feet

tric automatic heat-treating furnace for drill steel (Rock Products, January 18). The Ingersoll-Rand Co. perfected a new type of wagon or skid mounting for a light or heavy drifter (Rock Products, November 9). The Sullivan Machinery Co. got out three new models of diamond-core drills for depths not exceeding 1000 to 1200 ft. and for cores $1\frac{1}{8}$ in. to 2 in. in diameter (Rock Products, October 12). In the well-drill field the Armstrong Manufacturing Co. produced an all-steel drill, with an entirely electrically-welded framework, on caterpillar or crawler treads (Rock Products, September 14). Prominent among the special

Fig. 3. Pneumatic drill with self-rotator

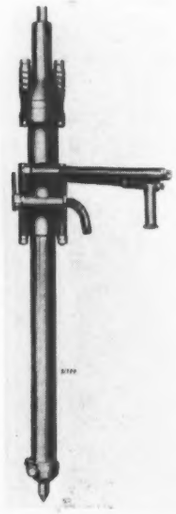


Fig. 4. Pneumatic rock drill with automatic lubrication features

features of this new well drill are the use of ball and roller bearings—showing how the frictionless type bearings are rapidly being adopted for nearly all rock products machinery. The Loomis Machine Co. announces it has developed a short-coupled well drill, with steel frame on four crawler treads, or two crawler treads, or tractor wheels. Other special new features of this drill are, frame interchangeable for steam, gasoline and electric power, all-steel compensating gear, brass brushed, and an interchangeable automatic throwout worm feed device, if desired.

In addition to the wagon drill mounting previously referred to, the Ingersoll-Rand Co. introduced a new air line lubricator, which may be used in either the pipe or the hose line of pneumatic rock drills. It is made in two sizes, pint and quart. (Fig. 2.) It is designed to atomize any lubricating oil or liquid grease that will flow at the temperature of the lubricator. The quantity of lubricant used is proportionate to the quantity of air flowing. This company also put out a new air-motor-driven feed for pneumatic rock drills to replace the customary hand crank. Two new "Jackstoper" drills, the R-30 and S-49 (Fig. 3) with self-rotation, were also placed on the market during the year by Ingersoll-Rand. These are for general stoping, raising and ring-drilling. Turning the throttle down to "midway" position admits air to the feed cylinder, but no air to the hammer, for pointing the hole. Turning the throttle down a little further admits air to the hammer cylinder, giving a light blow desirable for collaring the hole.

Fig. 6. One-man drifter drill

During July the Ingersoll-Rand Co. introduced three new drills requiring mounted machines, identical in construction but different in size, known as L-74, N-75 and S-70 (Fig. 1). The first weighs 117 lb., the second 144 lb. and the last 185 lb. Special features are, valve and valve chest in the rear end of the cylinder; the "flapper" type valve permits opening and closing of large ports with comparatively small travel; valve chest, rotation ratchet and rotation washer all keyed to the cylinder, to prevent slippage. They are built for wet operation. They are lubricated from an oil reservoir. The pulsations of air are designed to carry the lubrication alternately to the front and to the rear of the drill. Where unusually strong blowing capacity is desired these new drills can be furnished with an exhaust blower, which interchanges with the standard exhaust deflector. Another new I.-R. product is the "Stopehamer" drill N-38, especially designed for greater drilling speed, with entirely automatic lubrication. (Fig. 4.) It weighs 93 lb. and has a $2\frac{1}{8}$ bore, $3\frac{3}{4}$-in. stroke, length of feed (closed) $54\frac{5}{8}$ in., length of feed (extended) $76\frac{1}{8}$ in., giving a total feed travel of $21\frac{1}{2}$ in. Another development reported in 1929 was the increased use of the G-33 Calyx core-drill for prospecting limestone in depths from 50 to 250 ft. This drill uses chilled steel shot, or crushed steel, as a cutting medium in place of diamonds. It drills angular as well as vertical holes, as illustrated in Fig. 5.

The Cleveland Rock Drill Co. brought out a new line of drifters (Fig. 6) known as D7, D8 and D9, particularly suited to soft or medium rock. All are one-man machines, the D7 weighs 115 lb., the D8, 145 lb., the D9, 148 lb.

The Goodyear Tire and Rubber Co. brought out a new line of air hose, "Emerald Cord" hose, especially designed to resist abrasion. This hose is of braided construction and its carcass, consisting of high tensile cords, gives it great strength and high bursting and working presures. It is green in color.

The Ingersoll-Rand Co. introduced two new sizes of oil furnaces for treating drill steel, known as 6F and No. 26. Each furnace is designed to heat steels fast enough to meet the full capacity of a corresponding I.-R. drill sharpener, the 6F for the No. 34 sharpener, and the No. 26 for the No. 50 sharpener.

Hoists and Cranes

THE GROWING size of the excavator unit caused Sauerman Bros. to build some new and more powerful hoists. (Fig. 7). The new hoist for hard digging with a 3½-yd. slackline cableway is driven by a 300-hp. motor, and is larger and heavier in all respects than any similar machine used with this excavator previously. A similar hoist was developed for 6-yd. drag scrapers (Fig. 8) used for hard digging. Buckets up to 10-yd. have been used for loose materials. In the hoist illustrated the gear on the front

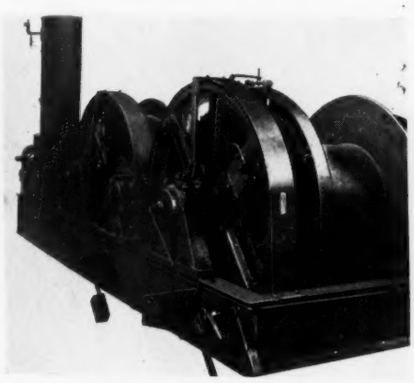


Fig. 7. Two-speed electric power unit for 3 1/2 cu. yd. slackline

drum is almost 8 ft. in diameter, and is also driven by a 300-hp. motor. Both these units are provided with air control of the friction clutches, to make them easy of operation in spite of their large size. Air compressors and air receivers are mounted on the bedframes of the hoists. In the cableway hoist the air valves are operated from levers in the operator's cab above the hoist. In the scraper hoist the valves are opened and closed by turning two small wheels at the side of the bed frame; these wheels are operated by cables attached to levers at the operator's station. The air pressure can be adjusted to give the amount of clutch action desired.

Another development in Sauerman slackline cableway hoists during the year was the application of air control to a power unit of smaller size—a 100-hp. machine operating a 1½-yd. cableway, which is one of the most popular sizes in commercial sand and gravel plants. The operator of this machine stands at the side of the hoist, and controls every movement of the hoist and of the cableway by means of the two small air control levers and the foot brake levers. The hand levers shown in the illustration control the pawls for dogging the drums when desired (Fig. 9).

In each of the power units described above, the motor and drums, as well as auxiliary equipment such as the compressor and air receiver, are mounted on an electrically welded rolled-steel bedframe, and both clutches and brakes are of the band friction type. The cableway power units are geared for two independent speeds on the front drum, a slow speed to give a powerful line pull when digging, and a high speed for rapid inhaul of the loaded bucket; the rear drum has a single speed for tensioning the slackline track cable. The scraper power unit has a low speed on the front drum for digging and inhauling the load, and a high speed on the rear drum for rapid return of the empty bucket to the digging point.

Other products of the year's grist were (in chronological order): A new variable speed hoist by the Construction Machinery Co. (Rock Products, January 5); a mechanically-operated, shoe-type brake for bridge drives of electric traveling cranes, hoists, etc., by the Electric Controller and Manufacturing Co. (Rock Products, January 5); a gasoline-engine operated hoist by the American Hoist and Derrick Co. (Rock Products, March 30); a 3½-ton, gasoline-engine powered hoist by the Novo Engine

Fig. 10. Electric vertical capstan car puller manipulated completely by the rope

Co. (Rock Products, April 27); a floor type, hand-operated winch by the Stephens-Adamson Manufacturing Co. (Rock Products, May 25); an oil-engine operated, vertical capstan car puller by the Lidgerwood Manufacturing Co. (Rock Products, June 8); a new "Anchor" puller-jack by the T. H. Edelbute Co. (Rock Products, June 22); a hand power winch by the Stephens-Adamson Manufacturing Co. (Rock Products, September 28); a differential chain hoist equipped with Timken roller thrust bearings by Robbins and Myers, Inc. (Rock Products, November 9); a new type of high-speed hoist equipped with emergency brakes automatically set in case of power failure, by the Lidgerwood Manufacturing Co. (Rock Products, December 7).

Since car pullers are included above—being on the border line of "hoists" and "transportation," reference is made here to a line of car pullers new to most rock products producers, made by the Silent Hoist, Winch and Crane Co. (Fig. 10). The principal feature of these capstan car pullers is that they do not have any clutch or brake or any other control levers, operation being merely in the manipulation of the rope. The same company makes a horizontal drum hoist or car puller which can be used for a variety of purposes.

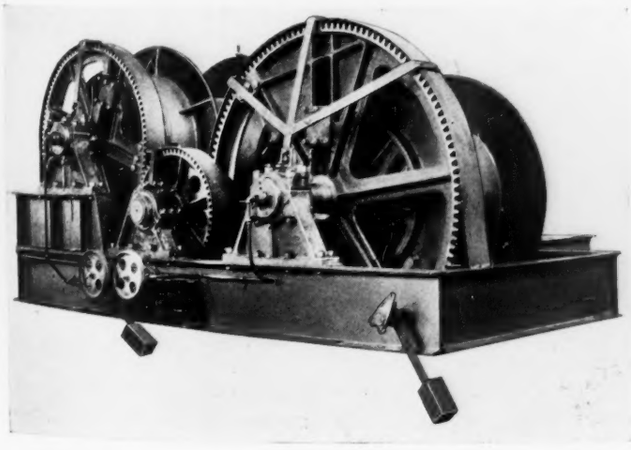


Fig. 8. Power unit for 6 cu. yd. heavy-duty drag scraper

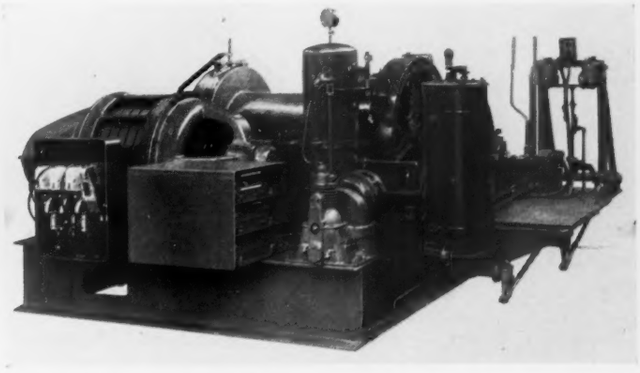


Fig. 9. Air-controlled power unit for 1 1/2 cu. yd. slackline cableway outfit

Excavating Machinery

AMONG the improvements and developments of a general nature in connection with excavating machinery in 1929 was the introduction and use of Maxim silencers on the exhausts of shovels and cranes powered with internal combustion engines, in localities where noise was objectionable (Rock Products, August 31). The smaller sizes of excavators were generally given larger power units than previously. At least one large shovel manufacturer began employing a special copper alloy steel extensively, as well as chrome-vanadium steel and manganese steel, for various parts subjected to great stress and wear (Rock Products, September 14).

It is said that after a period of constantly larger and larger shovels—up to those using 16-yd. dippers, and weighing 1550 tons—the present trend in the Lake Superior iron country is back to shovels of more modest size, because of the special skill required to operate the very large shovels efficiently. It is also said that a trend toward the use of part-swing shovels instead of full-revolving shovels is noticeable, because of the greater speed of the part-swing shovel. The very large shovels were never very extensively adopted in the rock products industry, but there does seem to be a tendency for the 1¼- to 3½-yd. shovels to become popular for quarry work rather than the smaller sizes of a few years ago. No tendency has been noted to return to the part-swing shovel of the railway-type shovel days.

The Marion Steam Shovel Co. announced its new 6200 type in November, and the accompanying view (Fig. 11) shows one of these under construction in the company's shops. This machine will have a 5-yd. dipper and is of the semi-revolving or part-swing type, designed to make up in speed and ease of operation for the smaller bucket, and to serve the same ends as the larger bucket shovels. An improvement over the ordinary railway type shovel is the crawling traction equipment and propelling machinery.

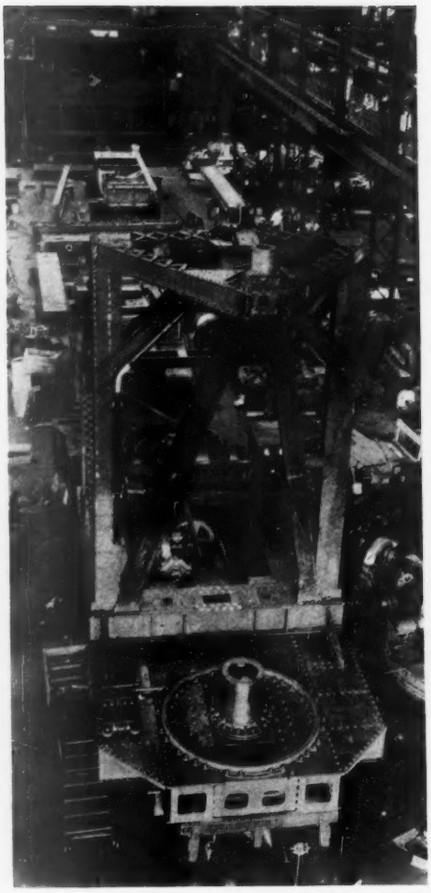


Fig. 11. New 5 cu. yd., part-swing power shovel with separate propelling units

This shovel does not depend on its main operating machinery for moving but has an entirely separate propelling power unit mounted rigidly on the lower frame. It has a 220-deg. swing. It is claimed to have a 20% faster operating cycle than the somewhat similar 4-yd., full-revolving shovel.

The Thew Shovel Co. announced its Lorain-55, a 1-yd. center-drive convertible crane, dragline and shovel (Rock Products, February 16), two new gasoline locomotive cranes, 15-ton and 20-ton (Rock Products, July 20), a ¾-yd. convertible crane dragline and shovel, the Lorain-45 (Rock Products, October 26), an improved drive for crawlers on all of its line (Rock Products, December 7), and recently announced its new larger, heavy-duty, 1¼-yd., Lorain-75-B, convertible shovel, crane and dragline (Fig. 12). It has all the original Thew features with improvements in the way of heavier and sturdier construction, greater power (Waukesha "W. L." gasoline engine rated at 97 hp., a 7x8½-in. Atlas Imperial Diesel engine, or an a. c. or d. c. electric motor). Power is transmitted from these units through a power take-off and silent-chain drive direct to the center-drive pinion, which in turn powers the three shafts, hoist, swing and travel or crowd. The application of power to all these shafts and operations is by means of newly designed, simplified internal expanding clutches. Roller-bearing type boosters on the hoist and swing shafts are provided for easier operation. The power unit has several improved mechanical features. In addition to the usual clamshell and dragline conversions this new excavator has a backdigger attachment—a newly designed simplified boom with a direct pull and application of power to the dipper. The Thew company also brought out an electrically-operated mine shovel (Rock Products, October 12).

The Bucyrus-Erie Co. announced about mid-year a new 1-yd. Diesel-engine-powered drag shovel, convertible for use as shovel, dragline, crane or clamshell (Rock Products, June 8). Other developments of the year by the Bucyrus-Erie Co. include the introduction of a 1-yd. Diesel-powered shovel with three independent engines—one for each motion. The main power plant is an Atlas-Bucyrus Diesel, which provides power for the hoist, while thrust and swing are provided for by two air-operated engines, the compressed air being stored while the main power plant is not required for the hoist. The smallest-yet-Bucyrus-Erie convertible was introduced early in the year—

Fig. 12. Heavy-duty, 1 1/4 cu. yd. convertible shovel

Fig. 13. A 16 cu. yd., revolving stripping shovel

a ½-yd. machine. During the year the ¾-yd. shovel, type 1030, was offered in Diesel as well as gasoline-engine drives. In the large shovel field Bucyrus-Erie claims the largest yet built (Fig. 13), a 16-yd. stripping shovel, which, with heaped dipper, is said to lift 23 yd. The capacity of this machine is estimated at 500,000 cu. yd. per month. Other developments of this company were in excavation outside the rock products field—a railway maintenance shovel, a tower excavator for Mississippi levee building and a bank grader for flood protection work.

Fig. 14. The 3 1/2 cu. yd. size of a line of Diesel or electric shovels

The Harnischfeger Corp. has recently announced "seven new models," which gives this company a range of excavators ranging from ½-yd. gasoline or electric to 3½-yd. Diesel or electric, in ¼-yd. gradations for the shovels up to 1½-yd. capacity, and 1-yd. gradations above. The new models are known as the 600-A (1-yd.), 650 (1¼-yd.), 700-A (1¼-yd. rock shovel), 750 (1½-yd), 775 (1½-yd. long corduroy model), 800 (2½-yd.), and 900 (3½-yd.) (See Fig. 14). These are convertible with the exception of 775, which has especially long crawlers for low ground pressure requirements. For this reason it can be used only as a dragline, clamshell-crane, or trench hoe (Fig. 15). Special mechanical features of the new excavators include: New internal expanding swing clutches; a stronger "fish-belly" type of shovel boom, with large cable sheaves, shock-absorbing springs on the power clutch and fully-enclosed, dust-proof full Diesel motors. The new 2½-yd. and 3½-yd. P. & H. machines are said to be especially designed for quarry and gravel-pit operation.

The Northwest Engineering Co. announced a new 1½-yd. convertible known as Model 6 (Rock Products, August 3). Recently the company announced a new "close-quarter" crowd. This crowd mechanism is not designed to replace the standard Northwest cable crowd, but to permit the machine to be equipped with extremely short boom and long sticks, if desired, and enables the bucket to be extended, when necessary, out to the limits of the sticks independently of the hoist either before, during or after hoisting. Under ordinary circumstances crowding is accomplished in the normal manner, but should occasion demand the new device provides for forcing the bucket on long sticks out beyond a short boom. This crowd makes it able to hold the hoist at any desired point while thrusting the bucket in or out without danger of dropping it and without having to hold it up with the engine. The Northwest company also announces a new oil-burning engine, based on gasoline-motor principles, having the usual ignition system. Some of the features of this motor are: A carburetor apparatus for low grade fuels; provision for adequate vaporization of the heavier fuels; special means for elimination of lubricating oil dilution. It is claimed that the new motor reduces fuel consumption approximately 10%, and uses oils ranging from 195-deg.

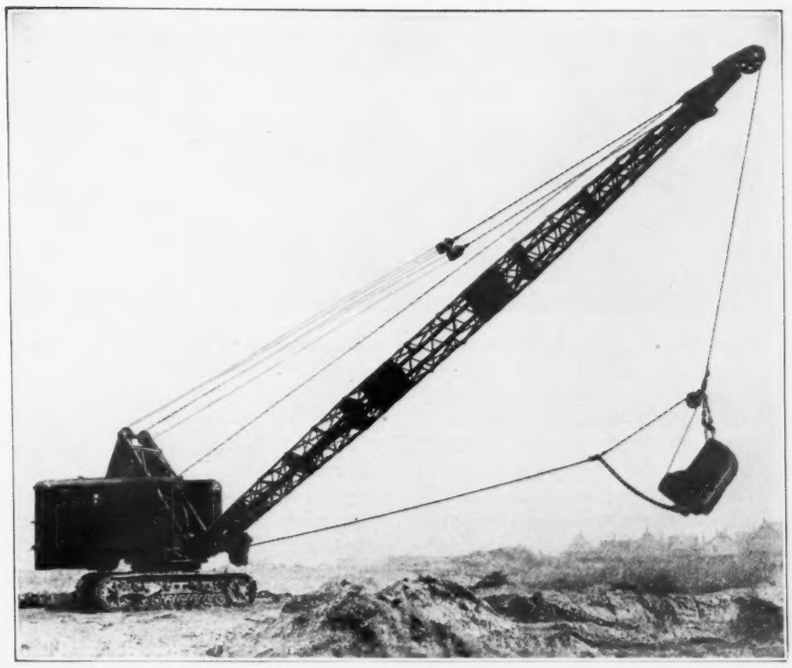
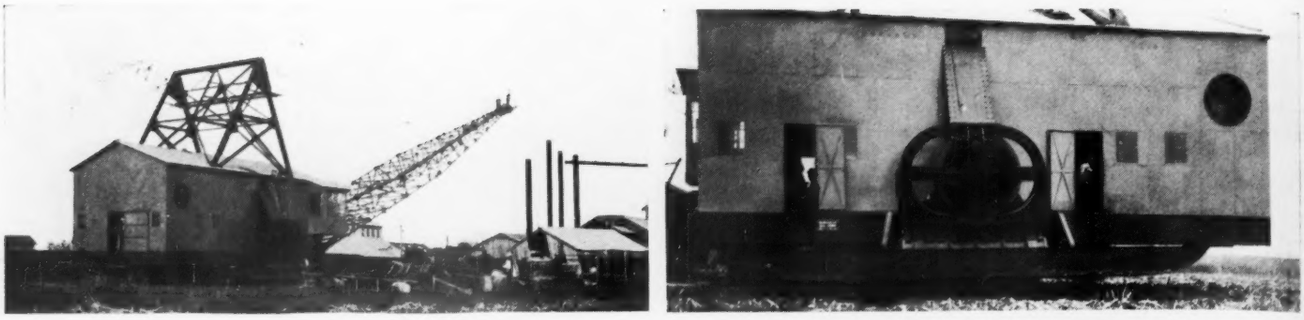


Fig. 15. Long crawlers feature the dragline adaptation of the shovel series shown in Fig. 14

Fig. 17. Extensible crawlers and independent crowd mechanism are features of this new shovel

Fig. 16. Illustrating ruggedness of new shovels



Figs. 18 and 18a. Two views of an extra large walking dragline, equipped with 6 cu. yd. bucket and designed especially for stripping

to 365-deg. C. distillation points. The engine is started cold on gasoline from a small tank for that purpose. Most recently the Northwest company has brought out its Model 7 clamshell, a larger machine than previously made, equipped, if not otherwise specified, with a 50-ft. boom and a 1½-yd. bucket for handling sand.

The Link-Belt Co., in January, announced a heavy duty ¾-yd. shovel, convertible to crane or dragline (Rock Products, February 2); a new line of locomotive cranes was announced in March (Rock Products, March 16).

The Ohio Power Shovel Co. announces its

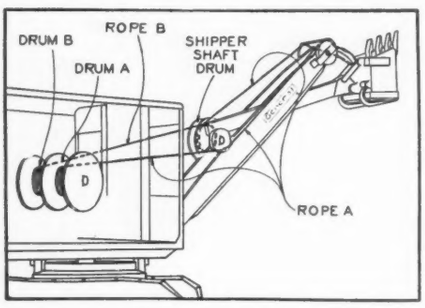


Fig. 19. Details of the simplified rope crowd on a small excavator

Lima 101 gasoline shovel, claimed to be the only fully Timken roller-bearing equipped excavator made, having roller bearings from boom-point sheave to large cone rollers on the rotating base. It also has a patented single-line hoist feature, claimed to give a 30,000-lb. pull at a speed of 100 ft. per min. It is made in 1- and 1¼-yd. sizes.

The Manitowoc Engineering Works developed an independent crowd mechanism. Another improvement is an arrangement for extending the crawler from its present 11-ft. 5-in. length to 15 ft. 10 in., with both ends slightly raised, so as to make it unnecessary to use floats except in very soft or marshy ground. The new crawlers reduce the bearing pressure to approximately 6.8 lb. per sq. ft. (Fig. 17).

The General Excavator Co., which is a newcomer in the field, announces that it has changed the power plant in its machine from a 4-cylinder to a 6-cylinder motor. These shovels are the ½-yd. type, convertible to clamshell-crane, dragline, backfiller, backhoe and skimmer. Among the special features is a patented rope crowd (Fig. 19) remarkable for its simplicity.

The Koehring Division of the National Equipment Co. is announcing an improved No. 401 1-cu. yd. convertible shovel, crane, dragline and pull shovel (Fig. 20). All gears except the turntable gear and swing pinion are enclosed and run in oil. All the machinery shafts, which enter into the operations of hoisting, drag, dipped crowd, boom hoist and swing, are mounted on roller or ball type anti-friction bearings. Other distinctive features are the independent cable crowd, the shovel boom shock absorber, the double outside band self-equalizing friction clutches, the dragline boom point fairlead, an accident-proof traction lock, and positive steering arrangement from the cab. It

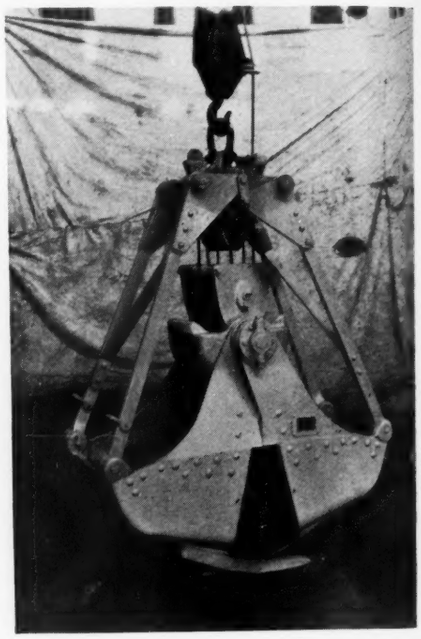


Fig. 22. New bucket of especially rugged design

is powered with a Koehring-Wisconsin gasoline engine, 5¼-in. bore by 6½-in. stroke, developing 100 hp. at 1075 r.p.m.

The Industrial Brownhoist Corp. recently introduced a new Diesel-engine operated, 25-ton capacity, locomotive crane (Rock Products, December 7). The Browning Crane Co. brought out the new Browning-Christie 8-wheel drive for truck cranes

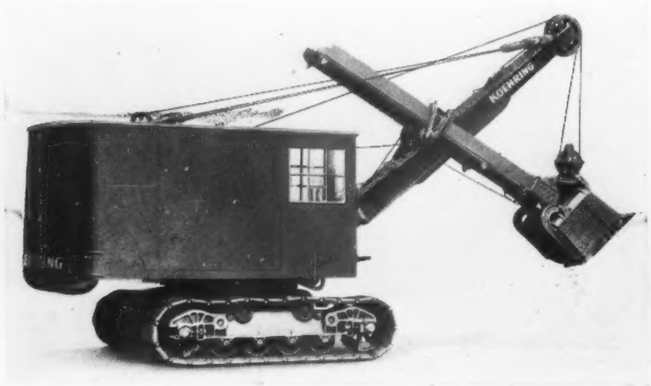


Fig. 20. An improved design of a 1 cu. yd. gas shovel

Fig. 21. Special type of excavator with novel crawlers

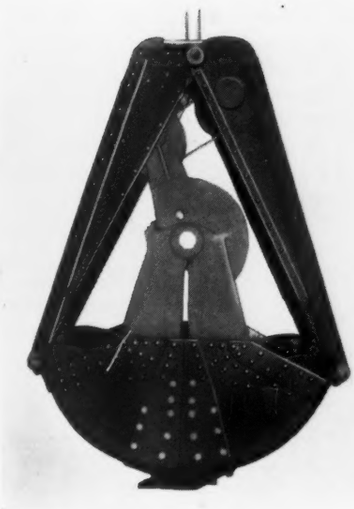


Fig. 23. Greater digging power is claimed for this new bucket

(Rock Products, April 13). The Speeder Machinery Co. introduced its Model B-3 convertible (Rock Products, April 13). The American Hoist and Derrick Co. brought out a three-speed crane with automatic gear shift (Rock Products, August 3).

The Monighan Manufacturing Corp. reports that in 1929 it built the largest walking dragline machine ever built (Figs. 18, 18a), known as Model 6150-W. It has a 150-ft. boom, a 6-yd. bucket and weighs 725,000 lb., so designed that the bearing pressure is but 6½ lb. per sq. ft. It is especially designed for large stripping operations. A side-stepping feature of the walking device adds to the boom reach.

In the way of excavators of special types the Trackson Co. promises four entirely new machines in the near future—to be exhibited for the first time at the 1930 Road Show. A distinctive type of crawler is among the features (Fig. 21). A new line of all-steel, wheeled scoops, the largest of 2-yd. capacity, was recently announced by the W. A. Riddell Co. (Rock Products, December 7).

Buckets

THE Hayward Co. has just announced a new Class "K" bucket (Fig. 22), a clamshell especially ruggedly designed, built in sizes from ¼-yd. up. The G. H. Williams Co. announced in July a 16½-yd. clamshell, said to be "the world's largest"; it is for handling coal. This company will exhibit at the 1930 Road Show for the first time its new "Champion" excavator bucket (Fig. 23), for which 25 to 30% greater digging power is claimed, through use of the lever-arm principle with multiple reeving of the closing line.

The Erie Steel Construction Co. brought out a new clamshell named the "multi-power" because of its combination of multiple-rope and lever-arm principles (Rock Products, August 17). The Owen Bucket Co. brought out two new and improved clamshells, Type "S" and Type "O," the former for loose materials, the second for hard digging (Rock Products, April 27).

The German firm, Reichman-Becker Polyp Co., brought out an orange-peel bucket with eight blades, or fingers (Rock Products, August 31).

In scraper buckets the Garst Manufacturing Co. announces a notable development in the form of a "rudder tooth" (Fig. 24A), which is attached to the middle of the back part of the scraper and has the effect of keeping the bucket on a straight line. The rudder tooth (patent has been applied for) is narrow in the direction of pull and has the big lobe or rudder-like portion at right-angles to the line of pull. It is designed to have the same effect on the scraper as the rudder on a boat, in that it keeps the rear portion from swinging or sliding when the scraper is being used on the side of an embankment or hill. Another development is use use of a landslide on the plow point (Fig. 24), which has the double effect of making the plow point double in thickness, giving it the strength of a straight thickness of metal back of the point, and the other advantage of helping to keep the scraper in a straight line when it is filled and is riding on the bottom "V" part of the scraper.

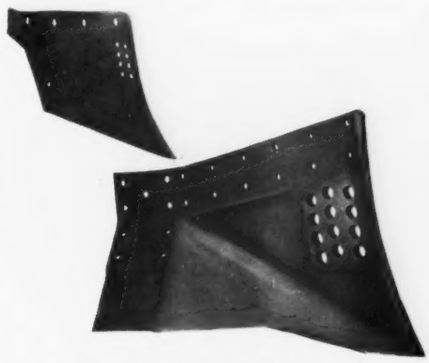


Fig. 24. Details of the plow casting of the scraper, showing the landslide (upper left)

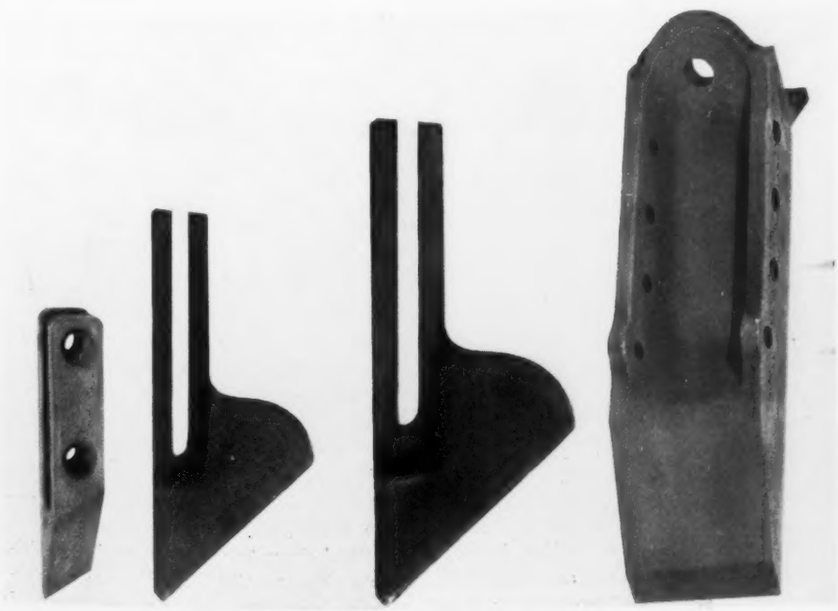


Fig. 24A. Front and side view of rudder tooth to keep scraper buckets moving in a straight line

Dust Arrestors

THE By-Products Recoveries, Inc., announced a new dry, barbed plate dust arrestor (Rock Products, September 28).

The Sly Manufacturing Co. reports many new installations in the cement industry (noted in the Review of the Cement Industry.)

Building Materials

TWO new products for use in rock products and other industrial plants were noted in 1929, a new non-rusting zinc alloy, produced by the New Jersey Zinc Sales Co. (Rock Products, March 30); and a new steel surface armoring for concrete floors by the Blair-Knox Co.

New Insulating and Protecting Coats

FOR SEALING joints in gas mains, for painting structural iron, motors, oil tanks, metal parts exposed to oil or vapor, mine machinery and similar equipment requiring sealing and insulating paints, the General Electric Co. is offering a series of lacquers in colors, for use where an oil-resistant, highly protective, durable and flexible insulating coating is demanded. The base of the new lacquers is an alkyd resin produced from phthalic anhydride and glycerine developed in the research laboratories of the General Electric Co. and marketed by that company under the trade name "Glyptal."

Pumps and Dredging Equipment

THERE appears to have been no startling developments in pumps and dredging equipment in 1929. There has been evidence of the use of special alloys of an abrasion-resisting character, where manganese steel has previously been used. For example, the Ellicott Machine Corp. has introduced the use of "Duranium" for pump cases, pump heads, impellers, revolving cutters, etc. It is a cast metal not only more resisting to abrasion than steel, but stronger and tougher. The Advance Foundry Co. reports the use of its "Strenes" metal for a pump shell with marked success. This material has long been very successfully used for chute linings, etc. This company has recently shipped several pump impellers of Strenes metal to the Florida pebble phosphate field, where they are said to outwear two or three of the impellers previously used.

The Ellicott Machine Co. has designed an entire new line of dredging pumps up to 12-in. size, equipped with heavy duty ball bearings (Fig. 25). This company recently issued a booklet on dredging that contains a wealth of valuable data, and illustrates some new and interesting units, such as sand and gravel dredging pumps mounted on a single base casting with steam, gasoline engine, Diesel and electric motor drives. The 12-in. pump, for example, is built in units with either a 4-cylinder 125-hp. Diesel, or a 6-cylinder 225-hp. one. This company also has an entire new line of agitators or cutters for sand and gravel dredging.

The Morris Machine Works further developed its new line of slurry and sludge pumps, which are finding a wide application in handling cement slurry. They have ball bearings for both radial and thrust loads. They are suction pumps, the same as this company's regular line of sand and gravel pumps. The graph of the performance of a 4-in. slurry is shown in Fig. 26.

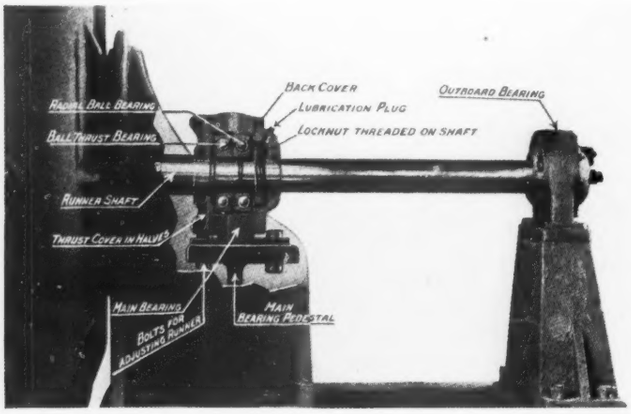


Fig. 25. Phantom view showing the type of main bearings used on a new line of sand and gravel dredging pumps

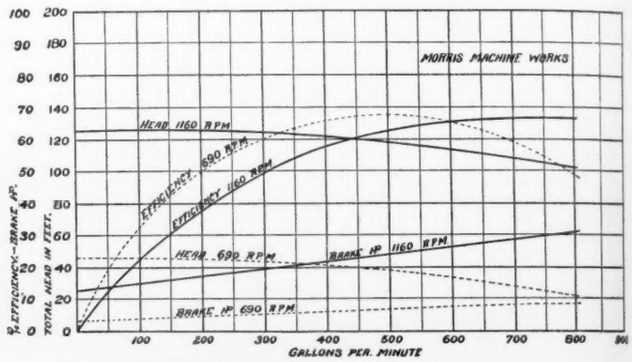


Fig. 26. Performance chart of a 4-in. slurry pump

The Eagle Iron Works installed a number of its "Swintek" screen nozzle ladders during the year, one for a gold dredge in Oregon, has a special attachment so that water can be pumped into the lime just back of the nozzle opening, which causes a vacuum in the regular nozzle throat, which sucks the gravel into the lime.

As an example of the constant effort to cut costs even in the smallest details, the B. F. Goodrich Rubber Co. states a rapidly increasing demand for its "Armorite," a form of elastic rubber developed by the Goodrich laboratory, of remarkable wear-resisting properties. It was found that a special form of carbon obtained from burning certain natural gases is so finely divided that the particles cannot be distinguished in a high-powered microscope. This is the secret of the properties of "Armorite." It is used in sheets of various thicknesses for lining chuts, hoppers (Fig. 28); for lining sand suction hose; for lining dredge sleeves, and even for lining sand and gravel dredge pipe. It is claimed ¼ in. of Armorite lining in chutes lasts a year where unprotected hard steel plates and chutes had to be renewed every five or six weeks. Fig. 27 shows a cross section of the special rubber lining material. This lining on a dredging sleeve, according to the Goodrich company, showed a maximum wear not over 3/32 in. during 27 months of service.

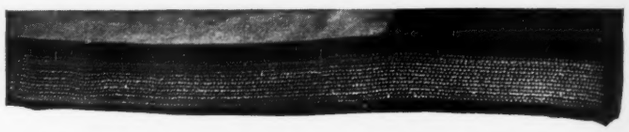


Fig. 27. Cross-section of special rubber lining material

The American Well Works brought out a new line of sump pumps (Rock Products, January 19), and a new line of deep-well pumps (Rock Products, June 22). Fairbanks, Morse and Co. brought out a compact portable pumping unit for handling dirt and trash (Rock Products, October 12).

Fig. 28. Chutes equipped with wear-resisting rubber lining

Refractories

THERE is nothing new to announce in refractories for rock products use. There is a distinct tendency toward the use of high alumina refractories. The Harbison-Walker Refractories Co. states: "Several years ago, due to increasing severity of operating conditions in the cement and lime industries, high-alumina brick came into favor because of their more desirable properties which better fitted them to meet the service requirements. The trend toward the use of high-alumina brick has become more pronounced since then and the curve is still ranging upward."

Transportation Equipment

IMPROVEMENTS in industrial locomotives and railway cars continue and locomotives and cars continue to hold their own in competition with motor trucks, tractors and trailers, the latter being the newest form of transportation for quarries and gravel pits. Every year sees the internal combustion engine win more victories over steam. It has been shown by tests that a 30-ton locomotive driven by an internal combustion engine will exert a greater starting pull than a 45- to 50-ton steam locomotive.

The Fate-Root-Heath Co. has just announced a new series of 6-wheel Plymouth gasoline locomotives (Fig. 31) in the same general class with its 4-wheel ones. The new locomotives are Models WLA 20-ton, WLG 25-ton and WLG 30-ton. They are especially adapted for heavy work on light rails and rough track. Their long wheel base, 6-wheel drive and equalized spring suspension permit speeds greater than possible with 4-wheel locomotives under the same conditions, it is said. The 20-ton locomotive is powered with a Climax "Blue Streak," R16, 6-cylinder motor developing 150 hp. at 1000 r.p.m. The 25-ton locomotive has a Le Roi, 6-cylinder, 165 hp. motor. The 30-ton locomotive has a Le Roi, 6-cylinder, 180-hp. motor. The power is transmitted from the final driving shaft in the gear case to the axles and wheels through six large sprockets and three short chains. The standard speeds are 2.6, 5.6, 9.7 and 15.6 miles per hour at engine speeds of 1000 r.p.m. Special speeds are 2.6, 5.6, 10.9 and 23.4. These locomotives are made in all gages from 30 to 56½ in.

The George D. Whitcomb Co. introduced

Fig. 30. An 80-ton, standard gage oil-electric locomotive, one of the largest of this type ever built

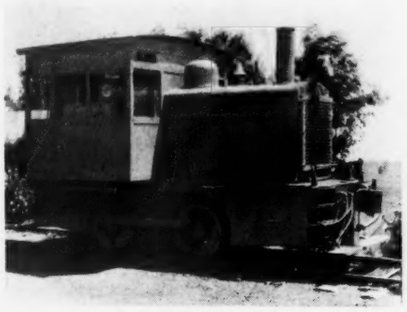


Fig. 29. Four-wheel, 33-ton gasoline locomotive

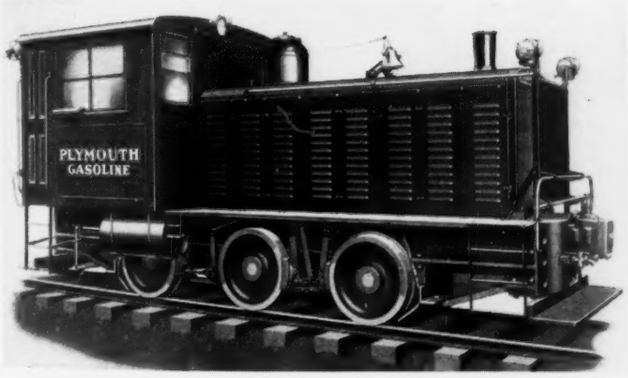


Fig. 31. New series of 6-wheel gasoline locomotives

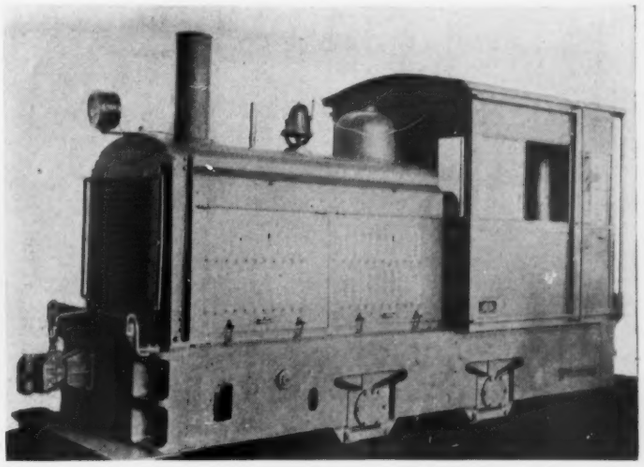
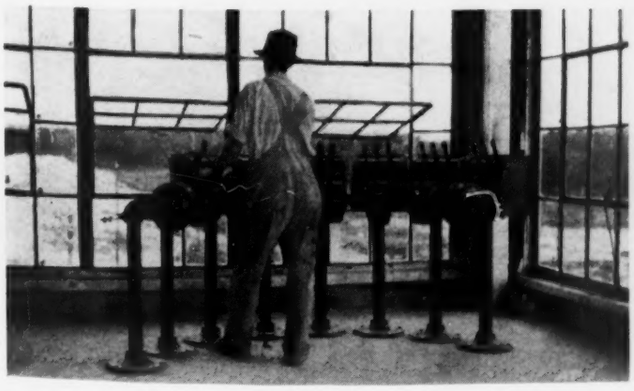


Fig. A 20-ton, 36-in. gage Diesel locomotive



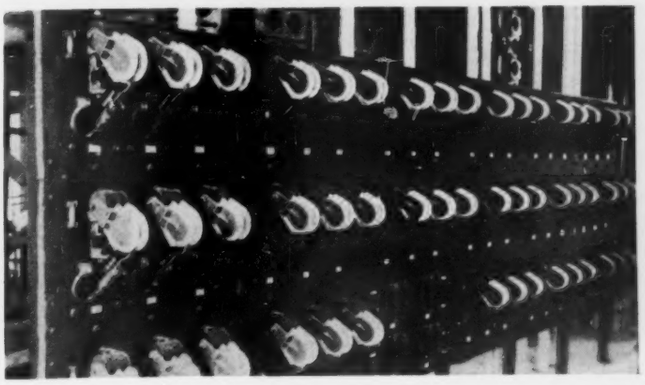


Fig. 32. Cars operating in two different quarries from a centrally controlled electric haulage system are controlled by only one man. Fig. 33 (right) shows the back of the operating panel

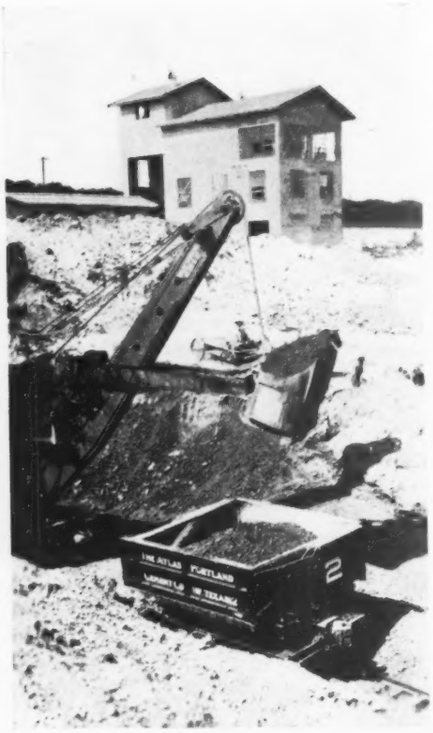


Fig. 34. Showing the location of the control tower

a 20-ton, 6-wheel, internal-combustion-engine driven locomotive in January. This locomotive is full gear driven, transmitting the power to the wheels through side rods. This company also built in 1929 an 80-ton, oil-electric locomotive, the largest of its type yet built, it is said. It has two 6-cylinder, 4-cycle, 300-hp. engines; the driving power comes from four electric motors. This locomotive is 29½ ft. over all and has standard gage, 4 ft. 8½ in. (Fig. 30).

In May the Cincinnati Car Corp. announced a new 1200 Series, gasoline powered, gear-driven locomotive (Rock Products, June 8). This company, which is a comparatively new one in the industrial locomotive field, now has a series in weights of 3, 4, 5 and 6 tons, 8, 10 and 15 tons. A 20-, 25- and a 30-ton model has dual power plant and transmission installation.

Mack Trucks, Inc., announced in April that it was prepared to build locomotives as well as trucks. These are of the gas-electric type in sizes 10- to 80-ton, 85- to 450-hp. (Rock Products, May 11).

Quarry cars continue to grow in size and increase in ruggedness. Early in the year the Easton Car and Construction Co. announced its "Duplex Phoenix" type with two 10-cu. yd., side-dump bodies mounted on A. R. A. standard gage trucks, with standard railway equipment such as automatic couplers (Rock Products, March 30). Another car developed by Easton during the year was a patented Phoenix type car equipped with Timken roller bearings (Fig. 36). This is said to be the first large capacity quarry car equipped with Timken bearings and used for power shovel loading. The car itself is standard, of 8-yd. capacity, for standard gage; the running gear is spring suspended to the underframe of the car. This car in competition with the same type having brass bearings is said to have proved that two Timken-equipped cars could be moved with the same power required for one with brass bearings, and the roller bearings required greasing not more than twice a year, compared to several times a week for the brass bearings. The Easton company also introduced, or rather reintroduced in modern design, the Granby car, which originated years ago in the Alaska mining fields. This is an automatic dump

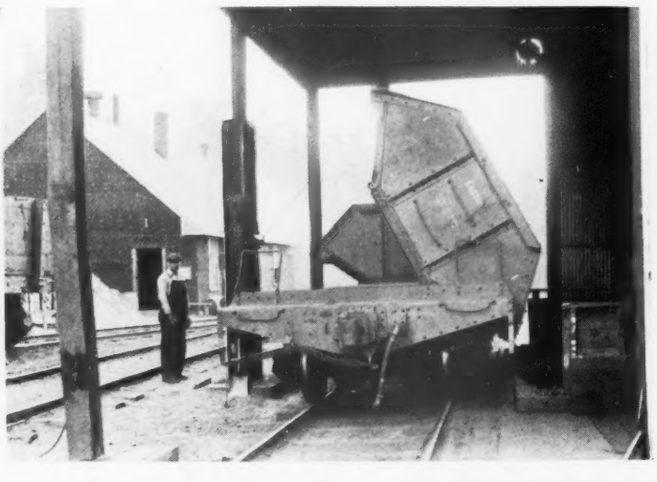


Fig. 35. Two 10 cu. yd. cars mounted as a unit

Fig. 36. One of new 8 cu. yd. cars roller-bearing equipped

Fig. 37. Automatic dump car made in 5 to 10 cu. yd. capacities

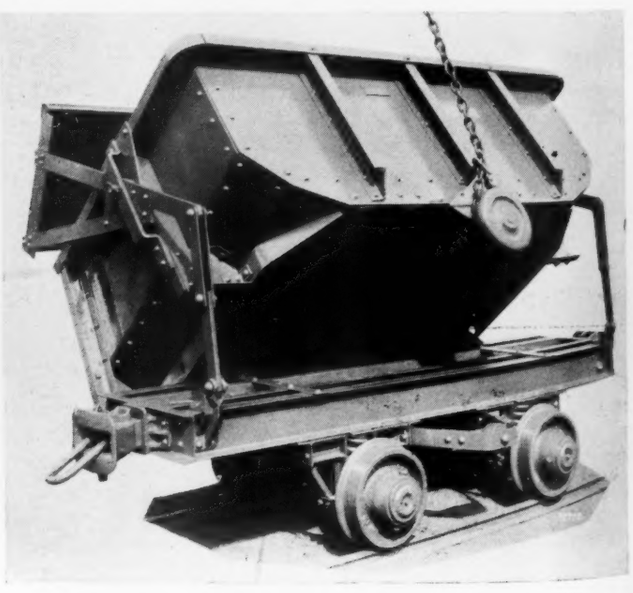


Fig. 38. Showing the dumping roller on the car (Fig. 37)

Fig. 39. A new 6-wheel truck with 15-ton body for quarry operation

Fig. 40. Truck shown in Fig. 39 in dumping position

Fig. 41. A new adaptation of standard car body to motor truck trailer

The Sanford-Day Iron Works developed a quarry or mine car with a novel type of drop-bottom (ROCK PRODUCTS, May 25). The Roberts and Schaefer Co. developed a novel reciprocating car dumper, which serves the purpose of a reciprocating feeder for a crusher (ROCK PRODUCTS, December 21). The Woodford Engineering Co. made what it considers a unique installation of its centrally-controlled electric haulage system at the quarries of the Atlas Portland Cement Co., Waco, Tex. The cars in the system serve the shale quarry and the limestone quarry alternately. The two quarries are in different directions from the mill. The cars are all controlled by a single operated located at the crushing plant who also controls the dumping of the cars at the plant.

Motor Trucks

The Easton Car and Construction Co. car. The dumping roller, which is located at the rear of the body, rides up over an inclined dumping rail, or the discharge point, without stopping. As the dumping wheel or roller engages the dumping rail the door automatically opens, and is closed again when the car body returns to normal position, as the roller descends the other side (Figs. 37, 38). The cars are made in 5 to 10 yd. sizes.

Fig. 44. Tractor pulling a caterpillar-mounted trailer at a quarry

Fig. 42. Standard car body fitted to motor truck chassis

Fig. 43. Truck with special tailboard for spreading sand and gravel

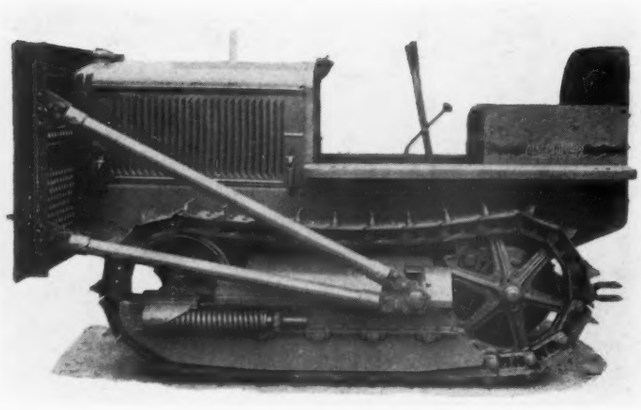


Fig. 45. Tractor with armored shield in front

built a 15-ton capacity all-steel body for the new Mack 6-wheel truck chassis, and this combination has already been adopted at two or more Eastern quarries (Rock Products, August 31).

The Relay Motors Corp. produced a 2-, 2½- and 3-ton motor truck on pneumatic tires, claimed to be especially adapted to handling aggregates (Rock Products, December 7). The American Aggregates Corp. went into the truck business to the extent of producing a Model "200" and a "300" Omort truck with 2-yd. and 3-yd. end-dump bodies, respectively (Fig. 43). The tail board is especially designed for spreading sand and gravel, or crushed stone. This truck is powered with a 4-cylinder Hercules motor.

Tractors and Trailers

The use of tractors with crawler treads and trailers, equipped with similar quarry car bodies, is a development of the past year. The Easton Car and Construction Co. is now mounting its "Phoenix" and "WonWay" car bodies on such crawlers. The Athey Trailer Co. has built trailers of these and other types, and they are being used in quarries, feldspar mines, etc., in competition with trucks and industrial railways. The G. H. Williams Co. has recently produced its 'Arch Girder" heavy-duty trailer. The Linn Manufacturing Co. has built a unit of interesting possibilities consisting of an Easton-Phoenix quarry car body mounted on a special chassis, the front of which is on wheels and the rear on traction crawler treads. The Caterpillar Tractor Co. produced some full caterpillar traction units of similar type (Figs. 44, 45 and 46).

The Koehring Co. produced a load-carrying unit suitable for quarry and gravel-pit use of a new and distinct type—the "Dumptor." This a dump body of 5 cu. yd. struck level capacity with full multiplane, or crawler, traction (Figs. 49 and 50). The power palnt consists of twin 4-cylinder engines. The dumping mechanism is a hydraulic hoist. Other features of the Dumptor are its low height of only 59 in. and its low bearing pressure of only 9.8 lb. per sq. ft. with an 8-ton load. The low height permits easy clearance for a conveyor belt as well as for shovel, crane or dragline loading. The "Dumptor" has four speeds forward: 1, 2, 3¾ and 5¼ miles per hour, and one reverse, 1⅛ miles per hour. It can turn in its own length.

Aerial Tramways

One of the most notable developments in transportation of the year noted by the editors was the widespread adoption of aerial tramways in the rock products industry. These have always been popular in Europe. One example of these has already been described in Rock Products (November 23), that serving the crushing plant of the Olympic Portland Cement Co. near Sumas, Wash.; two more are referred to in this issue, one at the Alabaster, Mich., quarry of the United States Gypsum Co., the other at

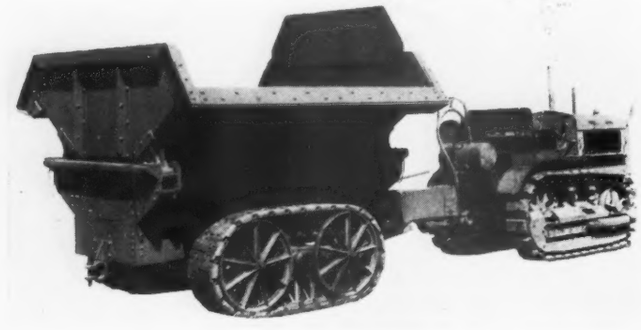


Fig. 47. Side-dump quarry trailer of 10-ton capacity

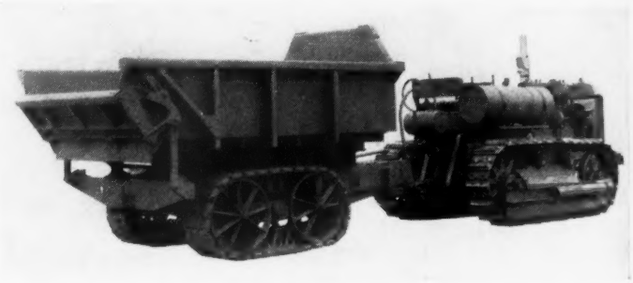


Fig. 48. Tractor and end-dump quarry trailer

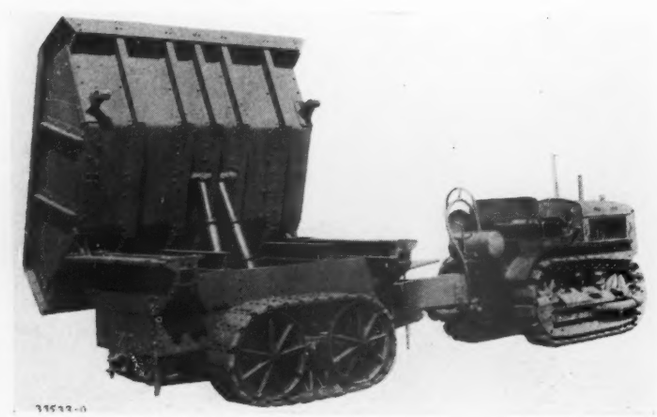


Fig. 47a. Showing the details of the dump mechanism (Fig. 47)

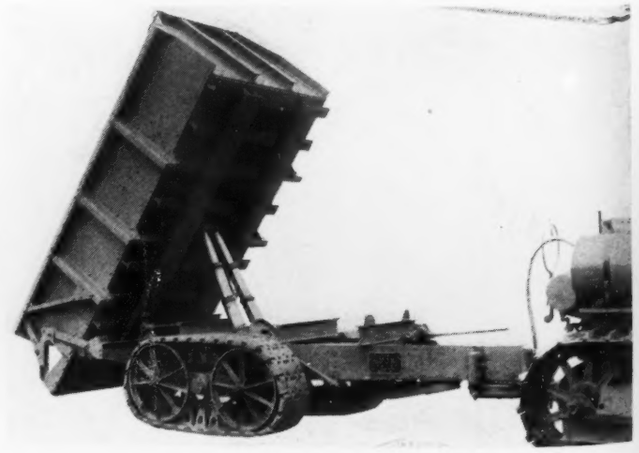


Fig. 48a. End-dump trailer shown in Fig. 48, in dumping position

Fig. 49. Tractor-mounted dump wagon with self-contained propelling mechanism

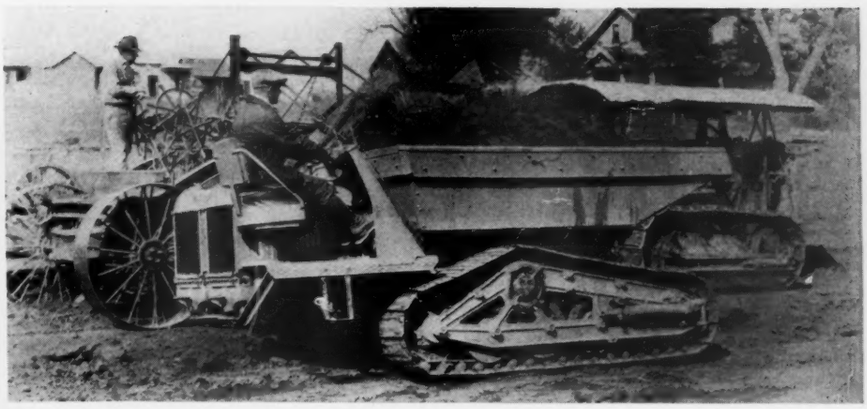


Fig. 50. Side view of unit shown in Fig. 49, showing typical loading scene

the new plant of the Century Cement Corp., Rosendale, N. Y., handling natural cement rock. Another, carrying sand and gravel, at the Ross Island Sand and Gravel Co. plant, Portland, Ore., will be described in detail in the next issue of ROCK PRODUCTS. These 1929 installations from coast to coast, under different and in each case interesting conditions, should serve to remind American operators of the usefulness of this method of transportation and its possibilities of solving difficult problems.

Ready-Mixed Concrete Trucks

TRUCK mixers, and agitator trucks for transportation of ready-mixed concrete, are now made in many variations. During the past year we described four new ones: One agitator truck by the LeBlond-Schacht Truck Co., using a body design by Arthur C. Avril, president of the Avril Tru-Batch Concrete, Inc., whose article on the status of the ready-mixed concrete business appears elsewhere in this issue (ROCK PRODUCTS, March 2); one ready-mixed concrete truck body by Bartlett and Snow (ROCK PRODUCTS, April 13); another agitator body by the Portland Concrete Machines Co. (ROCK PRODUCTS, June 8), and latest, a truck mixer, the Stepanian, designed by S. Stepanian, vice-president and general manager of the Arrow Sand and Gravel Co. (ROCK PRODUCTS, November 9.)

The Clinton Motors Corp. has developed, probably, the most complete line of agitator trucks on the market, including Clinton "concrete conveyor-conditioner" bodies of 3 cu. yd., 2 cu. yd. and 1 cu. yd. capacities. The last is just announced and is mounted on a Chevrolet 6-wheel truck chassis attachment. They are made with both high lift and regular dump body hoist. The high lift body is a 1929 development (Figs. 51 and 52).

The Highway Truck Mixer Co. has recently announced a 1-cu. yd. truck mixer, mounted on a International Harvester Co. truck chassis. The Transit Mixers, Inc., has produced several new models of the Paris transit mixer (Fig. 53).

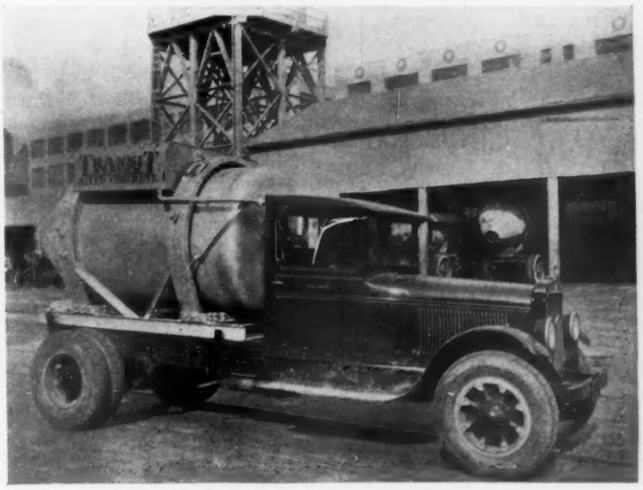
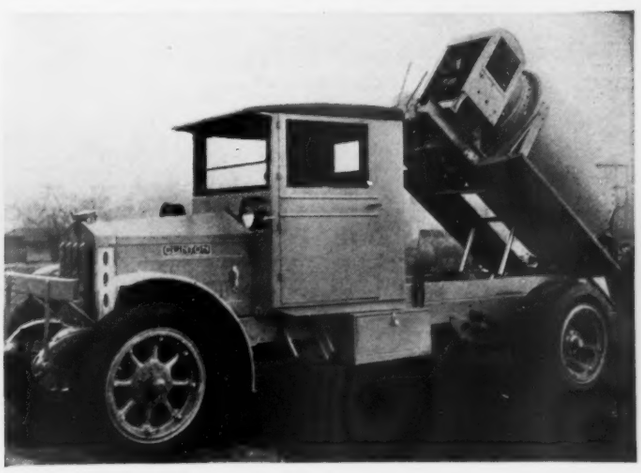


Fig. 53. New transit mixer on a "speed wagon"

Fg. 51. New truck mixer with special high-lift hoist



52. A 2 cu. yd. agitator truck in dumping position

Crushers and Pulverizers

THERE does not appear to have been any very notable developments in crushers during 1929. Early in the year the Allis-Chalmers Manufacturing Co. formally introduced its new line of Newhouse gyratories, a fine reduction crusher that had long been in preparation (ROCK PRODUCTS, March 16). Butterworth and Lowe brought out a new double-roll crusher, especially designed for abrasive materials (ROCK PRODUCTS, May 25). The Good Roads Machinery Co. further perfected its Champion roller-bearing jaw crushed, announced a year ago (Fig. 54). The Nordberg Manufacturing Co. reports the best year yet for Symons cone curshers, sales exceeding 200 machines. The size of this reduction crusher is constantly growing, a number of those installed this year being 7 ft. in diameter.

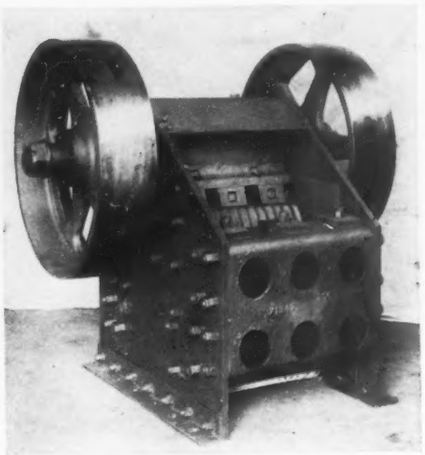


Fig. 54. Improved roller-bearing jaw crusher

Fig. 55. A 54-in. gyratory built in 1929

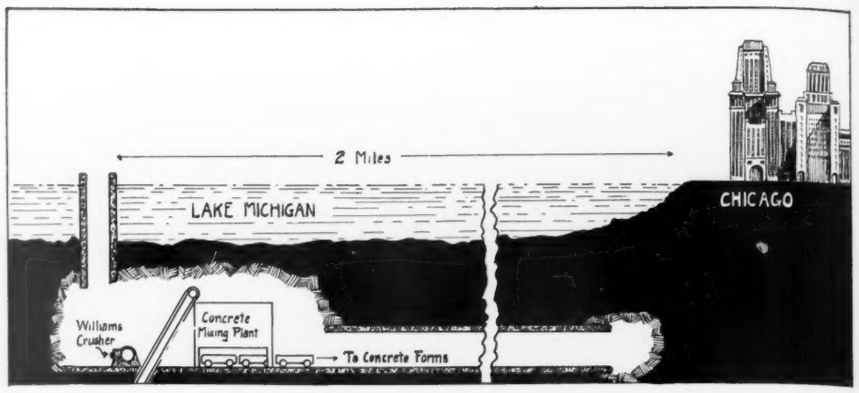


Fig. 57. A unique hammer mill installation

The Traylor Engineering and Manufacturing Co. announces the construction of a 56x72-in. "Bull Dog" jaw crusher of exceptional details, including a sectional frame, cast-steel and forged steel throughout, and incorporating the safety device described in our Annual Review a year ago. The Traylor company also built a 54-in. (Fig. 55) and a 60-in. "Bull Dog" gyratory crusher in 1929.

The Allis-Chalmers Manufacturing Co. announces improvements in its gyratory crushers as follows: The main frames of the complete line of McCully crushers have been redesigned, sections have been strengthened, the construction of the pins changed, and radial tie bolts have been added to further strengthen the bottom shells. An improved type enclosed dust seal has been developed, and a self-tightening clamp adjusting nut has been designed whereby the weight of the head and shaft are utilized to hold the adjusting nut firmly in the thread by means of an inverted wedge construction.

The larger sizes of McCully crushers are now provided with an improved type of suspension which places the reaction at a more advantageous point on the spider. To limit vertical movement of the shaft and head, the larger sizes of Superior crushers have been fitted with a thrust ring which is mounted on top of the spider hub. The Allis-Chalmers company built one 48x60-in. Superior jaw crusher in 1929.

The Universal Crusher Co. is exhibiting for the first time this month two new jaw crushers, 5x48 in. and 5x36 in. (Fig. 56). These are distinctly recrushers, and are especially designed to produce ¼-in. to 1½-in. sizes. The receiving openings are made large enough for 2 to 4-in. material. They have special corrugated jaws.

The Dixie Machinery Co. reports the manufacture and installation of its largest hammer mill in 1929. This machine was sold to a cement company for a primary crusher. It weighs 70 tons. Like all Dixie mills it is equipped with a moving breaker plate and reduces steam-shovel stone to compartment-mill feed in one single operation. W. C. Briggs invented and placed on the market an interesting renewal tip for hammer-mill hammers (ROCK PRODUCTS, September 28). The Williams Patent Crusher and Pulverizer Co. made what is considered its most unique installation in 1929 (Fig. 57). This in the new waterworks intake tunnel at Chicago, two miles from shore, and 220 feet under the level of Lake Michigan. The city is making some of its own concrete aggregate by crushing the wet mucky rock excavated from the tunnel. The crusher is the pusher type "non-clog" hammer mill.

Three new types of pulverizers were announced in 1929; an automatic apron "rotary jaw" crusher, by the A-A Crusher and Pulverizer Co. (ROCK PRODUCTS, July 6). George F. Pettinos brought out an improved form of pulverizer of the impact-attrition type known as the "Whirlwind" (ROCK PRODUCTS, July 6); the Straub Manufactur-

Fig. 56. New jaw crusher designed for recrushing

ing Co. announced a ball mill with spiral shaped ribs, known as the "Rib-Cone" (Rock Products, March 30).

Other types of fine-grinding equipment used more particularly in cement mills will be found listed under "Cement Mill Machinery."

Screens, Washers and Classifiers

THE year 1929 is a notable one in screening equipment because of the great increase in the use of vibrating screens, and the entrance into the vibrating screen field of at least two new ones. One interesting development was the combination of a Barber-Greene bucket loader and a Leahy "No-Blind" vibrating screen, for rescreening stock piles, etc. (Rock Products, October 12).

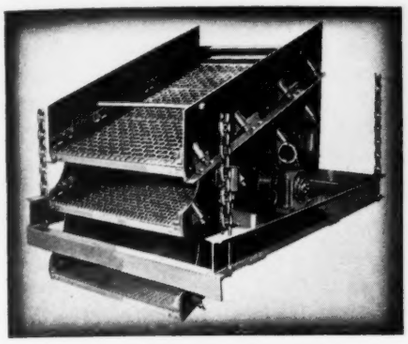


Fig. 58. Self-contained vibrating screen features weighted chain mounting

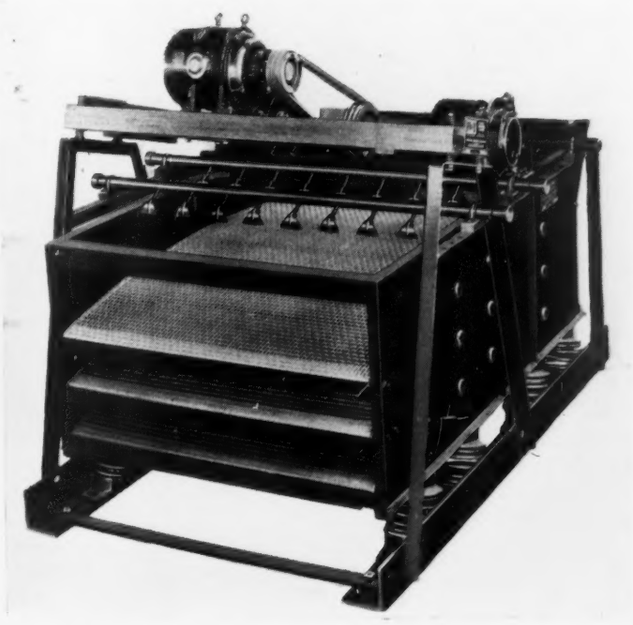


Fig. 60. A new triple-decked vibrating screen

In spite of the rapid spread of vibrating screens, the rotary screen continues popular, especially for all coarse screening. This is evident by reference to descriptions of new plants built in 1929. Perhaps for the first time large size rotary screens were equipped with roller bearings. These were the 72-in. Telsmith-Hercules screens installed at the plant of the Van Camp Sand and Gravel Co., Lebanon, Ohio (described in Rock Products, August 31). This screen has Dodge-Timken bearings and is claimed to have a capacity of 300 yd. per hr. (Fig. 63).

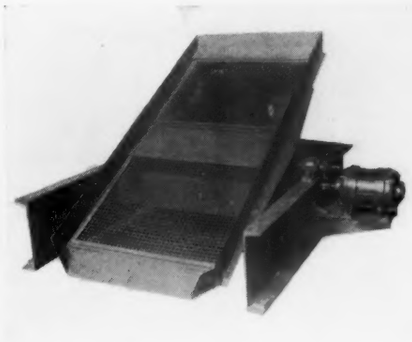


Fig. 59. Vibrating screen with protected eccentric shaft

One of the new vibrating screens (Fig. 58) has just been announced by the Stephens-Adamson Co. It is of the positive vibration type, driven by an eccentric shaft. It is said to differ from other types in that the rotor mechanism, containing two double roller bearings, eccentric shaft and four bronze grease seals, is a self-contained unit housed in a steel casting and does not depend upon the screen frame for rigidity—a design that simplifies mounting, as the rotor and drive can be set up and the screen assembly wheels can be adjusted to balance the reaction of the loaded screen, and together with the weighted-chain type of base suspension, is claimed to reduce the vibration transmitted to the building to a minimum. The device consists of three units; a structural steel base, rotor mechanism, and screen frame assembly. A multiple-strand V-type, cog-belt drive is used from the motor to the eccentric shaft vibrator. The new screen is made in sizes from 2x4 ft. to 5x8 ft. All sizes are available with triple, double or single decks, any of which can be detached, or additional decks added.

Fig. 62. Flat-angle, heavy-duty vibrating screen

Another new vibrating screen just placed on the market is the McLanahan," made by the McLanahan and Stone Machine Co. (Fig. 59). The eccentric shaft is under the screen surface, protected by a blanked plate. It is either motor-driven through gears or by belt.

The Deister Machine Co. has increased its range of Plat-O" vibrating screens, there being now nine standard sizes, from 2½x4 ft. to 4x8 ft., with single, double and triple decks (Fig. 60).

The Niagara Concrete Mixer Co. has made improvements to its Niagara screen, chief of which is a quick-change steel panel.

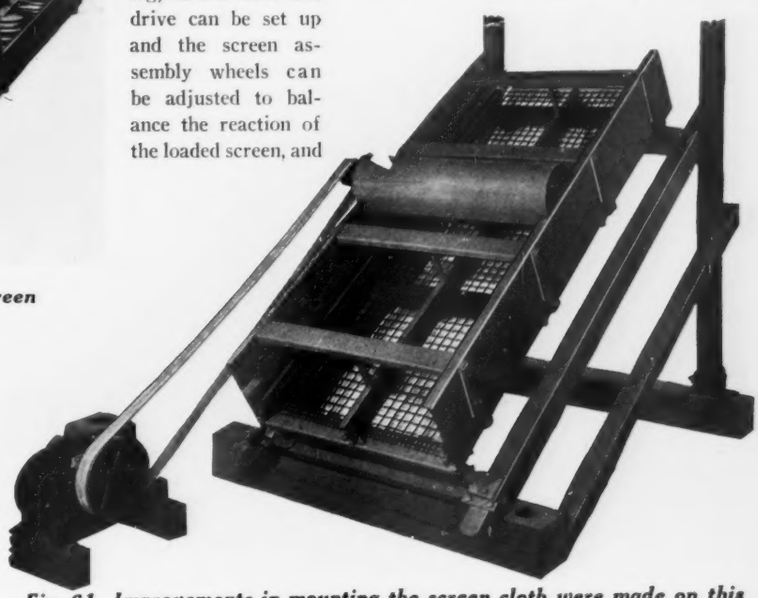


Fig. 61. Improvements in mounting the screen cloth were made on this vibratory screen

Other improvements include specially designed and built roller bearings. The range of sizes has been increased to include screens 6x10 ft., and in extraordinary cases 6x12 ft. This is in line with the increasing use of vibrating screens for separating large sizes, and even for scalping screens, for which capacities from 500 to 700 tons per hour is claimed fo ra single unit.

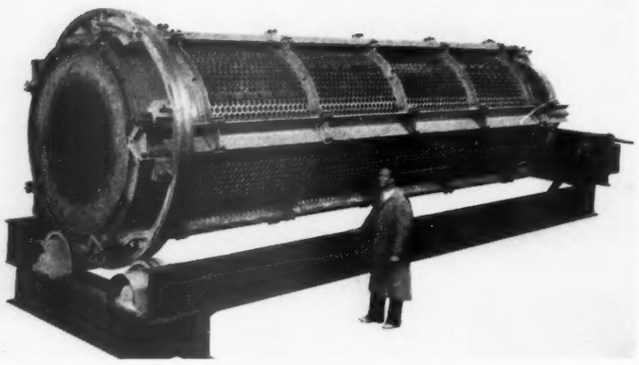


Fig. 63. Rotary scalper equipped with anti-friction bearings

The Universal Vibrating Screen Co. made improvements in the method of mounting the screen cloth and in its structural-steel frame details (Fig. 61). A new booklet recently issued by the company gives some figures on efficiency of screening various materials from 94.5 to 98% for limestone and 95.2 to 97.1 for sand and gravel. The source of the figures or the method of computing the efficiency is not given; but the data is interesting and it is to be hoped will lead to some real research in regard to screening efficiencies.

The Sturtevant Mill Co. announces that its new vibrating screen, briefly described in our Annual Review a year ago, which had not then advanced beyond the development stage, is now perfected. This machine is the flat angle heavy duty vibrating type suitable for installing over a bin or hopper, requiring minimum headroom. It is furnished in "skeleton" form (without housing), encased, and encased and hoppered, with or without feeder. It is suitable for delivering from one to three products. While it is of the high speed vibratory type delivering 1800 impulses per minute to the screen clothing, yet the six-sided cam runs at only 300 r.p.m. The clothing simply slips into and is clamped to its frame allowing quick, simple and easy replacement and the purchase of the wire cloth anywhere as there are no cloth attachments of any kind. This screen in the large size has an area of 40 sq. ft. which allows large outputs. (See Fig. 62.)

The Smith Engineering Works produced two new washers in 1929, an improved Telsmith-Hercules gravel washer. This is the type that uses chains suspended in the barrel for scrubbing. It has been so built that changing of screen sections is simplified greatly. The screen sections here are drilled to template; the hoops and angle blocks for attaching the jacket are bolted around the angles, not through them. The user can thus remodel his screen without drilling a single hole. He can change the lengths of the screen sections, shorten or lengthen the jacket, insert or remove a scrubber—all without machine work. This new scrubber is equipped with Timken roller bearings and with completely enclosed gears. To the single screw washer described in our Annual Review issue a year ago the Smith Engineering Works has added a double-screw washer of the same type.

The Eagle Iron Works developed a new washing attachment for its Eagle washer for the removal of shale from aggregates, which is said to be very successful, having handled materials with as high as 15% shale, which through the use of this attachment has been reduced to 1% and less, it is claimed.

The Ludlow-Saylor Wire Co. announces an improvement in 50x50-mesh steel wire

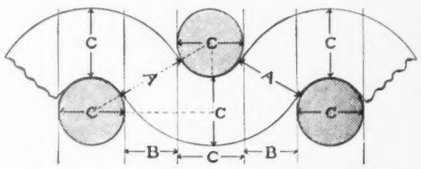


Fig. 64. Illustrating the method of design in an improved heavy wire cloth

cloth made of No. 33 W & M gage (0.0118-in. diam.) wire—the heaviest 50x50 steel wire cloth thus far made, the diameter of the wires being 0.0036 in. (44%) larger than the nominal opening between the wires. This opening is 0.0082 in. The accompanying sketch (Fig. 64) shows how this is accomplished. This sketch shows why the diagonal A, the available space between the parallel wires through which the transverse wires pass, is considerably more than B, the nominal opening between the wires. If C is the diameter of the wire: $\frac{C}{2}$ is the radius; A becomes a portion of the hypotenuse of a right triangle, of which the short leg is a dimension equal to $2\frac{C}{2}$, or C, and the long leg is equal to $B+2\frac{C}{2}$, or $B+C$. The hypotenuse being $A+2\frac{C}{2}$, A may be formed thus: $A=2\sqrt{(B+2\frac{C}{2})^2+C^2}-2\frac{C}{2}$.

A new type of screen, washer and feeder was introduced into this country in 1929 by the Ross Screen and Feeder Co. (Rock Products, May 11).

Conveyors

ONE of the most interesting developments in 1929 was the development of the vibrator tubular conveyor by the Traylor Vibrator Co. (Figs. 65, 66). The original vibrating conveyor was brought out over a year ago. The new type is said to be par-

Fig. 65. A new tubular vibrating conveyor

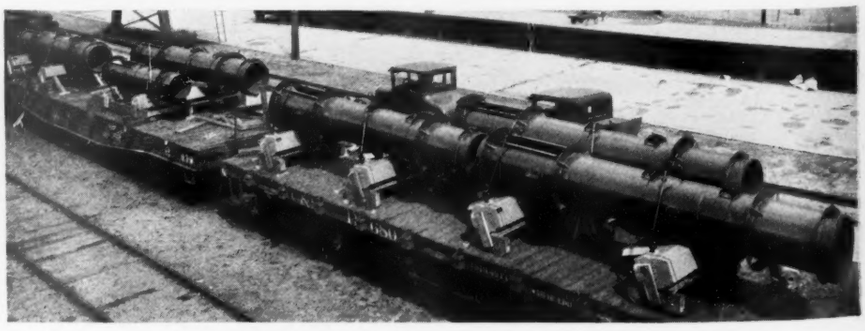


Fig. 66. Sections of the vibrator tubular conveyor on flat cars for shipment

Fig. 67. One of the portable conveyors at the Denny Hill project

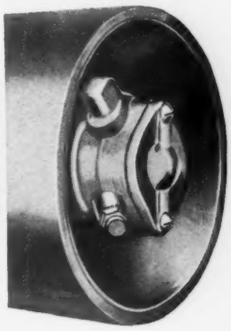


Fig. 68. Self-cleaning pulley ends on a conveyor carrier

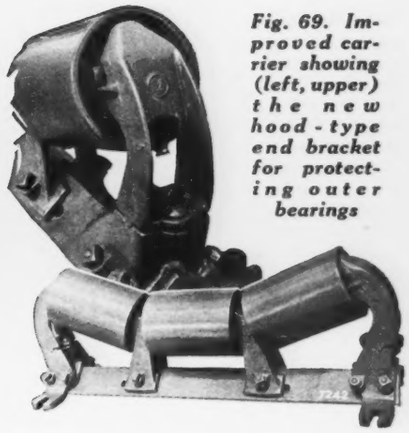


Fig. 69. Improved carrier showing (left, upper) the new hood-type end bracket for protecting outer bearings

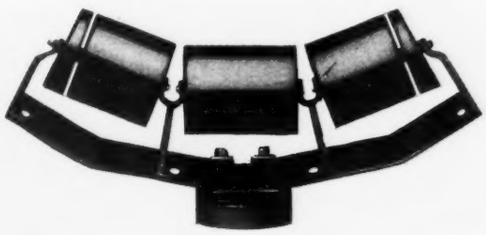
ticularly adaptable for handling hot materials like clinker and lime from kilns.

In belt conveyors the Boston Woven Hose and Rubber Co. introduced a new idea in a double-belt conveyor, one belt to drive and one to take the wear (Rock Products, March 16).

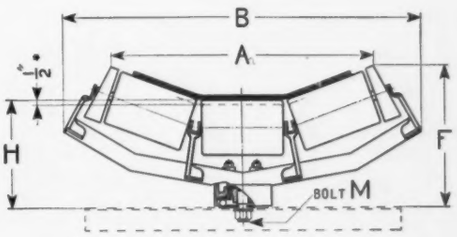
The Link-Belt Co. made a remarkable belt conveyor installation in 1929—for moving 5,000,000 cu. yd. of earth in the Denny-Hill regrade project, Seattle, Wash. (Fig. 67). The contractor had 300 working days in which to complete his contract. A shovel loads direct to a 36-in. belt conveyor, which carries it to the waterfront for loading on scows. The belt is in three sections with the following lengths, respectively, 1360 ft., 920 ft. and 600 ft., centers. The field conveyors have 200 ft. centers.

The Stearns Conveyor Co. announces added improvement to its self-aligning conveyor idler (Figs. 70-73). The improvement consists in the addition of counter-weighted discs at the outer ends of the concentrating pulleys; all pulley units are of the live pulley, dead shaft type which permits the mounting of the counter-weighted discs on the dead shaft. Thus any lateral movement of the belt from the center line of the conveyor will cause the idler to rotate on a ball-bearing turntable, changing the angle of the idler with respect to the center line of the conveyor; the addition of the weighted discs at the outer ends of the concentrating pulleys provides added resistance to the belt when wandering from the center line, accentuating the centering action of the idler. All the pulley units have Timken bearings.

The Robins Conveying Belt Co. introduced a new type of demountable troughing idler (Rock Products, July 20), and a rotating rubber squeegee of spiral ribbed construction for cleaning belt conveyors (Rock Products, August 17). This company's rubber-cushioned idler, brought out sometime ago, has recently been improved fastening



Left—Fig. 70. Conveyor idler equipped with counter-weighted discs on the outer ends of dead shafts to correct belt alignment. Right—Fig. 71. Details of the improved idler shown in Fig. 70



The Stephens-Adamson Manufacturing Co. announces several changes in the construction of its "Sacon" and "444" belt-conveyor carriers. Both styles now have closely spaced pulleys of steel tubing with self-cleaning malleable-iron pulley ends, designed to prevent accumulation of dirt or moisture. New bearings have been designed, and each shaft rotates in two double Timken bearings housed in a new type oscillating housing. Improved grease seals for each bearing help retain the lubricant better and make it difficult or impossible for grit or moisture to enter. A new hood-type end support gives additional protection to the outer bearing (Figs. 68,69).

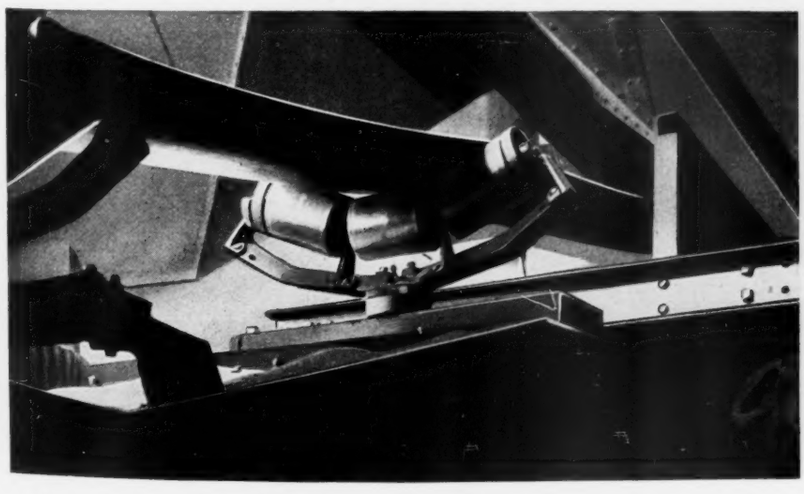


Fig. 73. One of the self-aligning idlers (Fig. 70) mounted on a tripper

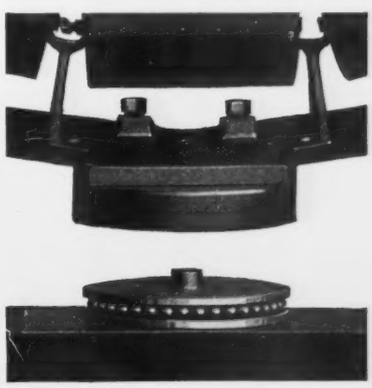


Fig. 72. Ball-bearing turntable feature of idler (Fig. 70)

steel strips to both sides of the conveyor (See Fig. 74). Primarily these are to prevent spilled material from banking up against the rubber-cushioned pulleys, but a secondary function is as a cleaner to take off any sticky material that may adhere to the pulleys. The strips are placed so that the edges are about ⅛ in. from the pulleys, The strips are bolted to all brackets, the bolts extending through holes in the brackets. Another improvement is in the design of the end brackets, which are, as formerly, of malleable iron; a hooded shape has been designed to protect the bearings and shed dirt and moisture away from the pulleys.

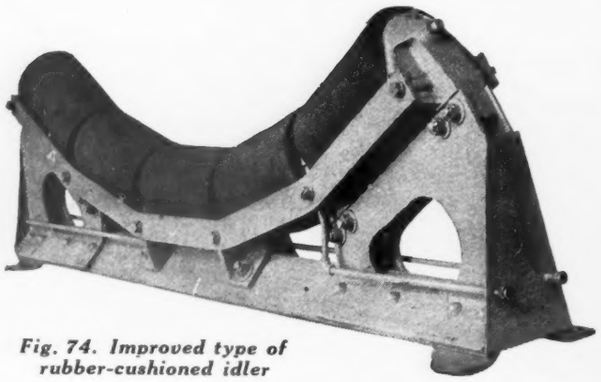


Fig. 74. Improved type of rubber-cushioned idler

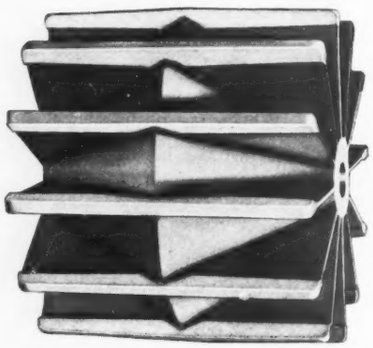


Fig. 75. Wing-type tail pulley designed to check belt wear

One of the Robins company's latest traveling trippers (Fig. 76) was installed for a coal company in Maine. It is a double, reversible unit, discharging from either side. This unit consists of two standard Type S, heavy duty trippers with modified drive arrangement fitted with the Robins Timken-equipped idlers. Such a tripper makes the most of the space allotted for the storage conveyors and also permits greater flexibility in laying out the ship unloading facilities. This tripper, while applied to the handling of coal in this case, is applicable to the handling of any bulk materials.

Sprout, Waldron and Co. has developed a special "wing" type tail pulley (Fig. 75) for belt and bucket elevators and belt conveyors. This pulley is designed to overcome the wear on the belt from abrasive materials that get between it and the pulley. It has a cone-shaped hub with wings designed so that they are close enough to pull without damage, yet far enough apart to prevent material from lodging between belt and pulley. It is made in sizes 16 to 40 in.

The Allis-Chalmers Manufacturing Co. records an interesting development of its apron type, pan conveyor and feeder (Fig. 77). The illustration shows four of these feeders 26 in. by 23 ft. 3 in. centers. These are of the continuous overlapping pan type with overlapping ends on the pans. Two of these are used for limestone and two for

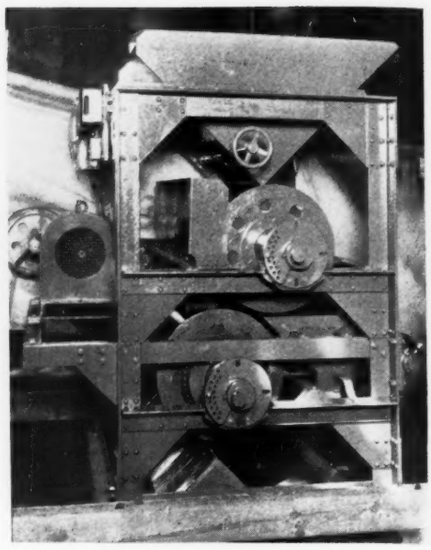


Fig. 79. A large magnetic separator handling 100 tons per hour of silica sand

granulated slag. Another development in connection with its standard apron type device is the application of a direct-connected motor drive to this machine, making a self-contained unit. The motor is of the enclosed, fan-cooled type, driving the feeder through a worm gear speed reducer connected to same with a bushing type flexible coupling. Variation in the speed is obtained through the ratchet drive mechanism of the feeder. This makes a very compact unit which has been applied in connection with any of the company's standard apron feeders (Fig. 78).

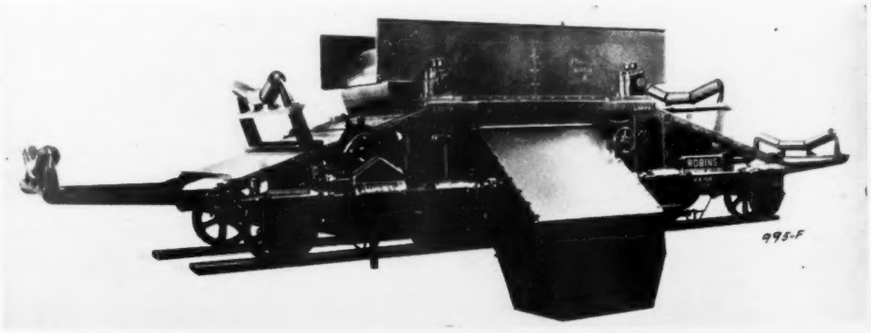


Fig. 76. Traveling tripper of the double-reversing type

Fig. 77. General group view of apron pan conveyors and feeders

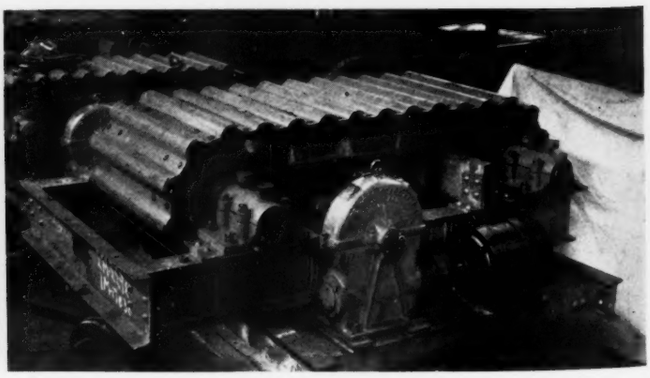


Fig. 78. One of the new 30-in. by 5-ft. apron feeders show the direct-connected drive arrangement

While not exactly classed as a conveyor, magnetic separators are usually installed in connection with belt conveyors, so for want of a more appropriate place, we will consider them at this point.

Fig. 80. Improved type of portable unloader

The Dings Magnetic Separator Co. reports that in 1929 it built the largest magnetic separator to date — for the National Silica Co. plant, Oregon, Ill.,; it handles 100 tons of sand per hour and removes the smallest particles of iron, which are very objectionable in silica for certain kinds of glass, and for other purposes. This machine is the double-drum type and weighs 20,000 lb., and stands about 12 ft. high (Fig. 79). Another 1929 product of this company was a new automatic spout magnet.

In portable conveying equipment the Barber-Greene Co. brought out two specially designed belt feeders for getting under hopper-bottom railway cars (Rock Products, February 16 and July 20). Mention has already been made under "Screens" of a combination bucket loader and vibrating screen made by this company in 1929.

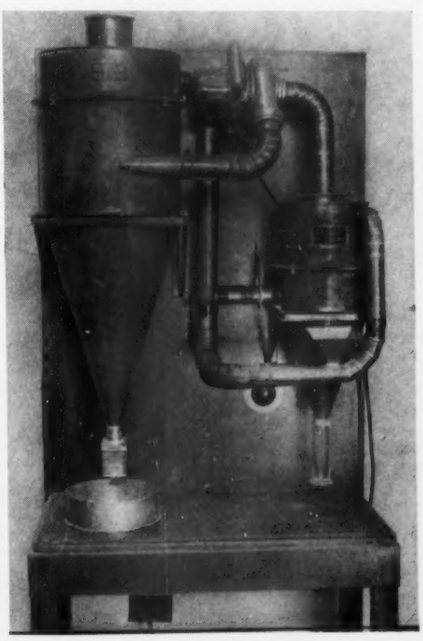
The Ottumwa Box Car Loader Co. added to its already considerable line a new model "A" (Fig. 80), designed to materially reduce weight. The main pulleys are made of electrically welded pressed steel. The main bearings are double-ball, self-aligning S. K. F. enclosed in dust-proof boxings. Belt adjustments can be made at three points; the troughing pulleys have Timken roller bearings. The entire machine is Alemite lubricated. Standard sizes have 18 to 24-in. belts.

Laboratory Equipment

SEVERAL interesting pieces of equipment for the control laboratory were brought out. Among these are the S. W. Jameson Co.'s new machine for testing lime hydrate (described in Rock Products, February 2 issue). This trowel pull tester is designed to test lime under conditions identical to those found on the job, replacing the plasticimeter used in standard methods of testing. The machine, simply constructed, quickly measures the pull of any plastic material and indicates the answer on the dial of the scale in pounds and tenths. It reproduces the actual plasterer's test to a form where the answer is had in a few seconds in easily understood figures.

A new testing sieve with special inside rounded corner, from which easier cleaning and more accuracy results, was developed by the Newark Wire Cloth Co. This sieve, described in Rock Products, January 5 issue, is made in 3, 5, 6, 8, 10 and 12-in. diameters in accordance with National Bureau of Standards and A. S. T. M. specifications.

A precision laboratory air separating unit for the cement plant chemist has been developed by Federal Pneumatic Systems, Inc., Chicago. The device is designed to classify portland cement beyond 325-mesh, the minus 325 being fractionated four ways by the unit. The assembly also may be employed in the mill room to establish the rate of clinker feed, according to the claims advanced. Capacity of the laboratory size is about 2 lb. of cement per minute. Its usefulness in grinding control is apparent, for it gives a true indication of the proportion of ultra-fines (minus 325 mesh) in the standard 200-mesh product.



Laboratory air separating unit classifies products beyond 325-mesh

The separator can be easily installed and operated. It contains no screens or moving parts, classification being effected by two opposing centrifugal currents of air. Adjustment for mesh is made by a single mesh valve at grade desired. Its use is not limited to cement, lime products, gypsum or silica being handled with equal efficiency. The separator is built in 33 standard sizes ranging from the laboratory unit of 2 lb. per minute to a commercial unit handling 4 tons per hour.

Rock-Dusting Coal Mines Will Prevent Explosions

THERE is no excuse for great explosion disasters in coal mines in the light of present knowledge, it was asserted recently by George S. Rice, chief mining engineer, Bureau of Mines. Extensive bituminous coal-mine explosion disasters are caused by accumulation of coal dust, whether with or without the presence of methane, Mr. Rice pointed out, and the Bureau of Mines has demonstrated repeatedly that the dangerous coal dust can be neutralized by rock-dusting the mine.

The following recommendations for rock dusting mines were proposed by Mr. Rice:

Employ thorough rock dusting in all bituminous and sub-bituminous mines. Rock dust should be distributed in every entry, air course and room. In rooms that have been stopped the rock dusting should extend to the face and over the gob. In active workings rock dusting should extend at least to within 40 ft. of the face.

It is desirable that the miners in every working place be supplied with a pile of rock dust so that they may distribute it from time to time as the face advances in addition to the rock dust that may be scattered periodically by rock-dusting machines or rock-dust crews.

In some partly rock-dusted mines where the back or parallel entry has not been rock dusted or the main haulage road has been inefficiently rock dusted explosions have extended through these entries to nonrock-dusted or imperfectly rock-dusted entries and working places. In no case has this occurred where the rock dusting has been thorough.

Rock dust any place where the samples gathered regularly show that the incombustible content of the dust from the rib or floor (including ash of the coal, natural and artificial rock dusting and moisture) falls below 55%, so that an average of at least 65% may be maintained throughout the mine. This recommendation is urgently made by the Bureau of Mines.

Technical Paper 448, "Coal-Dust Explosions in Mines," is based upon observations made after many explosion disasters and upon the results of explosion tests in galleries and in the experimental mine at Bruceton, Penn.

Prime Movers

NOT only does the field for internal combustion engines constantly expand, but improvements and changes are continually being made. The Waukesha Motor Co. led off the year with its new "Great Six" gasoline engine (ROCK PRODUCTS, January 19). Just as in motor cars there has been a strong tendency to use 6-cylinder motors in many industrial units, such as the smaller shovels and cranes, where 4-cylinder motors were formerly used. The Northwest Engineering Co. developed a new 6-cylinder engine especially for its shovels and cranes (ROCK PRODUCTS, February 2), and more recently a new oil engine, based on gasoline engine principles (ROCK PRODUCTS, October 26). Fairbanks, Morse and Co. brought out a new line of small (1½ to 7½-hp.), portable gasoline-kerosene engines (ROCK PRODUCTS, June 22).

The Westinghouse Electric and Manufacturing Co. developed a new metal known as "Konel" for the moving parts of internal combustion engines (ROCK PRODUCTS, August 31).

The Continental Motors Corp. announced a new 6-cylinder gasoline engine (Fig. 81) (ROCK PRODUCTS, September 14). A new line, known as Model H was announced a year ago. These are 4-cylinder, slow-speed, industrial motors and incorporate some improvements made this year.

The Climax Engineering Co. extended its line of "Blue Streak" motors announced in these columns a year ago, by four new ones. All this line is designed to operate on either gasoline or distillate. This series is now available in sizes of 6-in. bore, 7-in. stroke, to 5¼-in. bore, 6½-in. stroke (130 to 72-hp.) (Fig. 82).

The Buda Co. announced a special Diesel-powered electric generating set (ROCK PRODUCTS, March 20). This company has just announced a new series of 6-cylinder gasoline engines. Some of the special features for this new motor are: Crankcase ventilation, specially designed dirt-proof breather and oil filler cap; crankcase and cylinders of chrome nickel alloy iron; main oil distributing line rifle-drilled full length of crankcase; rifle-drilled, long-centered connecting rods, with positive lubrication of piston pin with oil under pressure; 7-bearing crankshaft; provision for oil filter; provision for fuel pump; removable cover for cylinder water jackets.

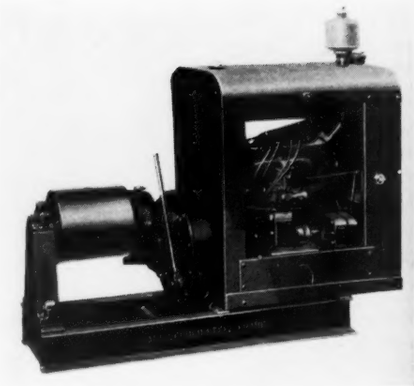


Fig. 83. Diesel engine mounted on steel welded frame

The Wisconsin Motor Co. is just announcing a new series D, a 6-cylinder series of gasoline engines in three sizes (Fig. 84), with bores 5¼, 5½ and 5¾ in., strokes

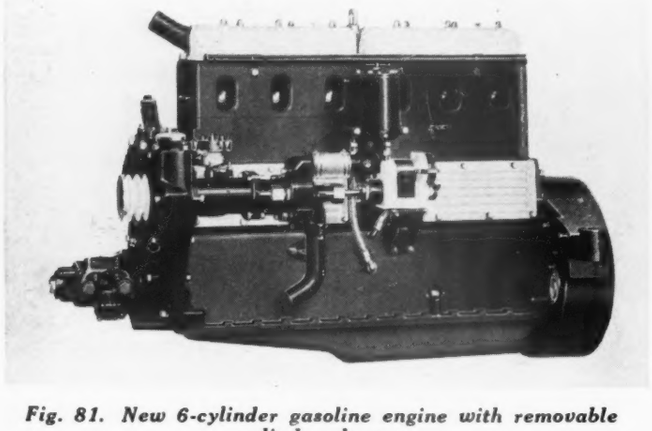


Fig. 81. New 6-cylinder gasoline engine with removable cylinder sleeves

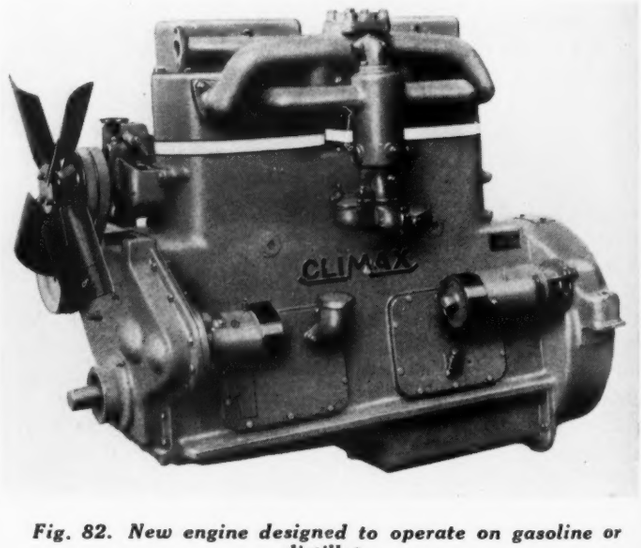


Fig. 82. New engine designed to operate on gasoline or distillate

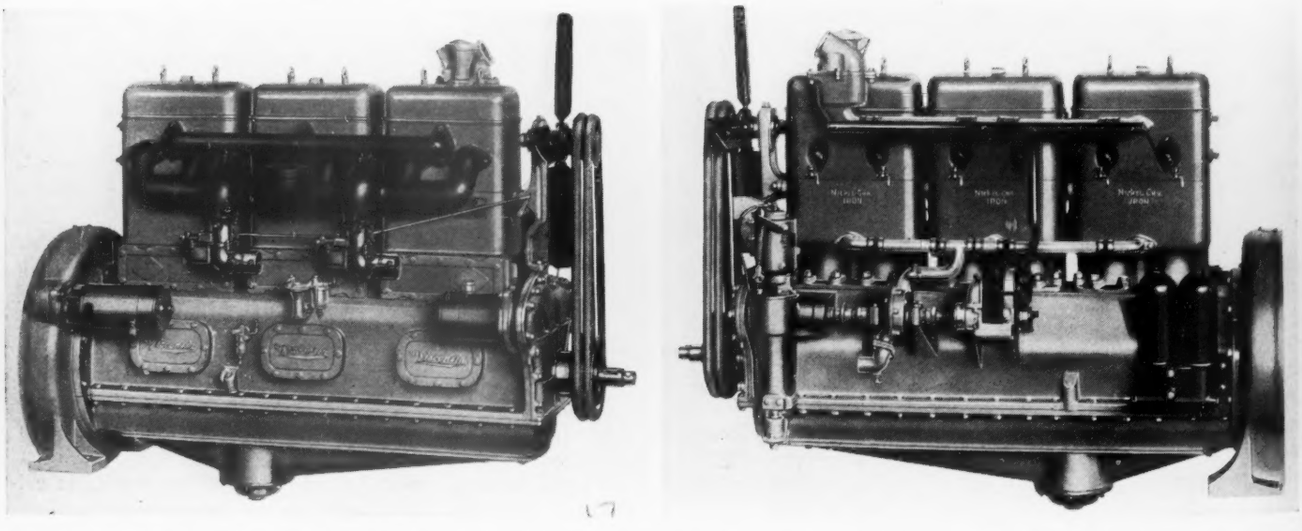


Fig. 84. Front and rear view of new 6-cylinder gasoline engine built in three sizes, developing 110, 115 and 125 hp. respectively

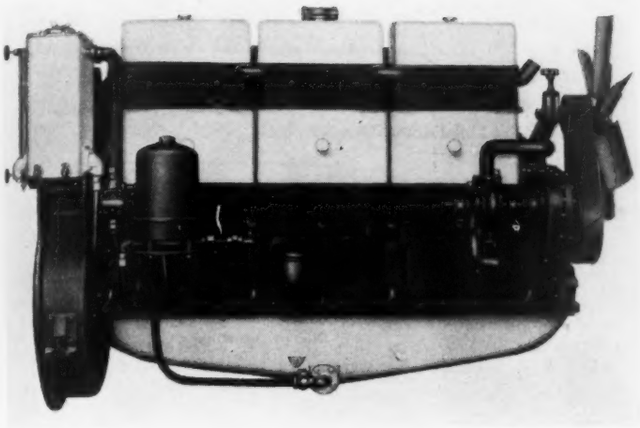


Fig. 86. New 6-cylinder, 180-hp. Diesel engine

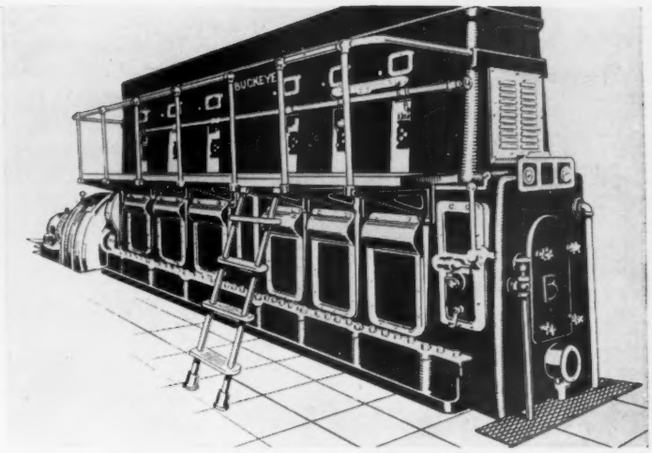


Fig. 87. Vertical type Diesel engine developed for quarry field

6½ in. (110, 115 and 125-hp). They are the valve-in-the-head type, have magneto ignition, electric starters, provision for a Kingston governor, provisions for oil filter and fuel pump, and other Wisconsin motor features.

The Hercules Motor Corp. introduced an "OX" series of small size gasoline engines (Rock Products, October 26). Since then a series of still smaller engines, the "OO" series, has been introduced.

The Novo Engine Co. developed a new 4-cylinder motor for especially rugged service, such as driving a rock crusher (Fig. 83). It has a heavy duty wide face pulley and clutch, direct-connected on the crankshaft. The crankshafts of these engines are mounted completely on anti-friction bearings. Timken roller bearings are used in the end position and New Departure ball bearings in the center position. The engines are provided with man-hole plates in the crank case, through which all adjustments on connecting rods, oil pump, etc., may be made without removing the engine from its mounting or destroying its alignment. These motors are made in 14 to 35 hp.

Progress in the Diesel engine field seems to have been largely confined to installations of existing models, many such having been noticed in our descriptions of new plants. The Buckeye Machine Co. announces a new vertical type Diesel (Fig. 87), some of the special features of which are said to be: Air turbulence to produce complete combustion; full pressure lubrication throughout; cylinder heads removed without disturbing manifolds or piping; inbuilt air filter; inbuilt lubricating oil filter; all parts enclosed. The Buda Co.'s new M. A. N. Diesel engine, 6-cylinder, 6½-in. by 8¾-in., developing 180 hp., is shown in Fig. 86.

The Young Radiator Co. produced a new line of radiators for engines from 200 to 300-hp. (Rock Products, January 5).

Speed Reducers—Power Transformers

NEW applications of speed reducers are constantly being made, and many improvements and refinements have been made in the gears themselves, since their introduction into the rock products industry.

The Stephens-Adamson Manufacturing Co. equipped its JFS variable speed reducer, described in our Annual Review number a year ago with ball bearings (Rock Products, July 6). The Farrel-Birmingham Co. developed a new Sykes gear generating machine for helical spur and herring-bone gears of very large pitch. This company made some interesting installations in the new plants of the United States Gypsum Co., perhaps the first extensive use of geared speed reducers in gypsum mills. The Foote Bros. Gear and Machine Co. developed a new worm gear reducer (Rock Products, September 14).

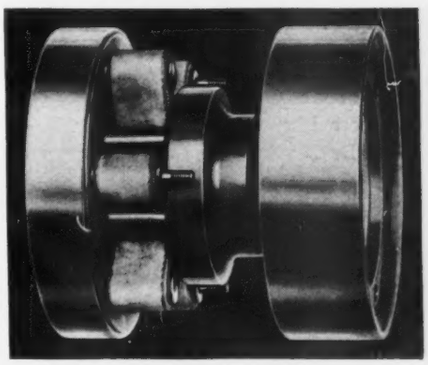


Fig. 90. New high-speed flexible coupling with cover removed

The Palmer-Bee Co. further extended its line of herring-bone speed reducers, described in Rock Products more than a year ago. This company's latest contribution is a new high-speed coupling (Figs. 88-90), which consists of three major parts: Two flanges, to be fitted to the connected shafts, a third member through which power is transmitted from one flange to the other. This third member is an endless belt of specially woven

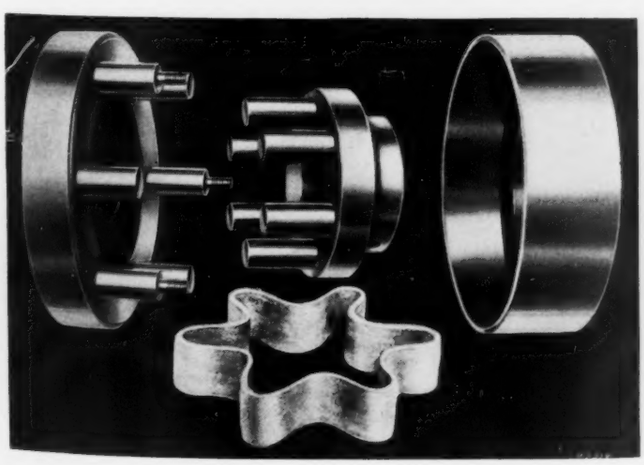


Fig. 89. Disassembled view of new high-speed flexible coupling

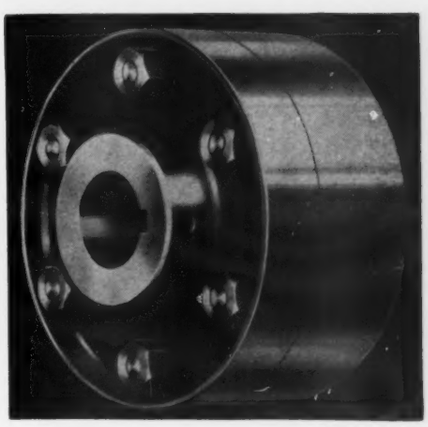


Fig. 88. Assembled view of flexible coupling shown in Fig. 89

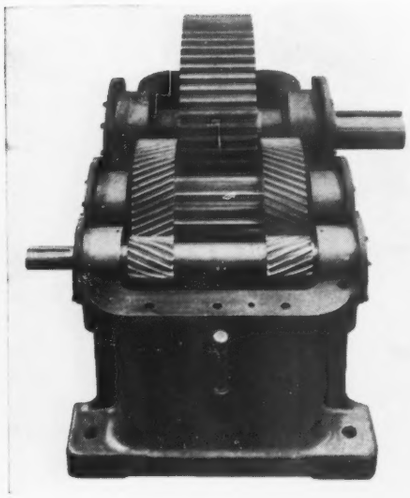


Fig. 91. New herring-bone rack-generated continuous tooth speed reducer

fabric of high tensile strength, treated with Whitmore lubricant.

The De Laval Steam Turbine Co. reports a number of novel installations during 1929, a few of which are illustrated (Figs. 92-96).

The W. A. Jones Foundry and Machine Co. announces a new line of heavy duty herring-bone Maag gear drives (Figs. 97, 98, 99), mounted in Timken roller bearings throughout. The principal features claimed are sturdy construction and ideally balanced design of housing weight, housing ribbing, unique provision for inspection of pinions and gears through threaded holes instead of flat plate covered openings, and the use of Maag gears for low speed reduction. The Maag principle is said to provide approximately three times the rolling action that is obtained with the usual standard involute gear, thus insuring a comparatively higher efficiency in gear-tooth action. The company states that due to the larger and safer capacity of this new gear drive it is better able to compete with ordinary spur gearing or belt and pulley drives, even in the larger sizes of drives. It has been applied to crusher drives where hitherto some form of belt transmission has been considered essential.

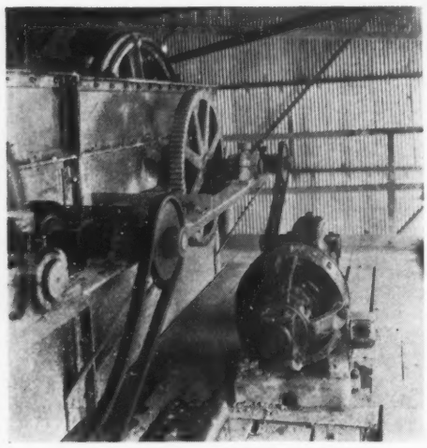


Fig. 92. Kiln feeder driven through a reducer; ratio of reduction, 16 1/2 to 1

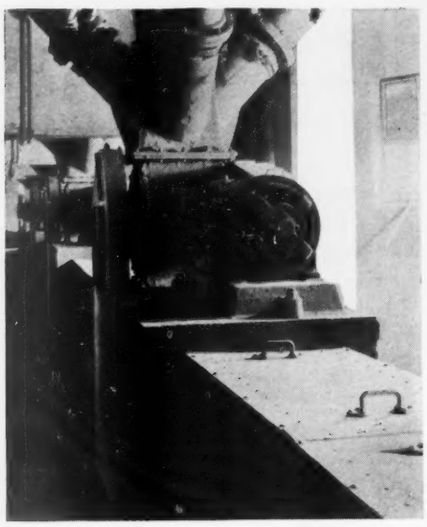


Fig. 94. Reduction drive in blending bins

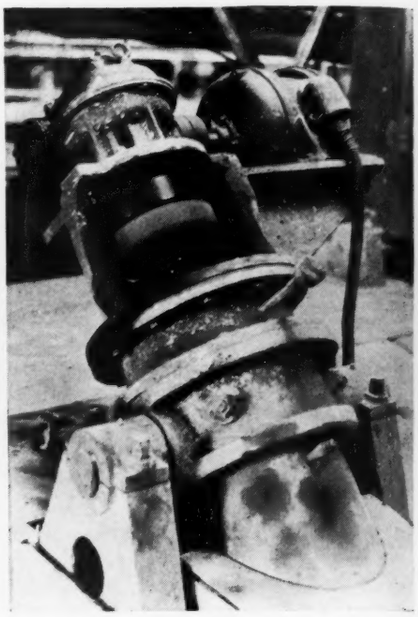


Fig. 93. Speed reducer driving an inclined screw feeder; reduction ratio, 7 1/4 to 1

An illustration of the development of speed reducers for special purposes is given by Gears and Forgings, Inc., in a three-speed automatic stoker drive (Figs. 100-101). This unit drives a screw type coal stoker. The motor has 1½ hp. at 1800 r.p.m. and drives through a worm and worm gear into a change gear box of three speeds, by means of bevel gears and a vertical shaft to a jack shaft, and from this by means of a set of spur gears to the screw shaft.

The Morse Chain Co. reports a number of interesting installations in the rock products industry of its silent chain driven gear reducer and flexible coupling, both of which have been described in previous issues of Rock Products.

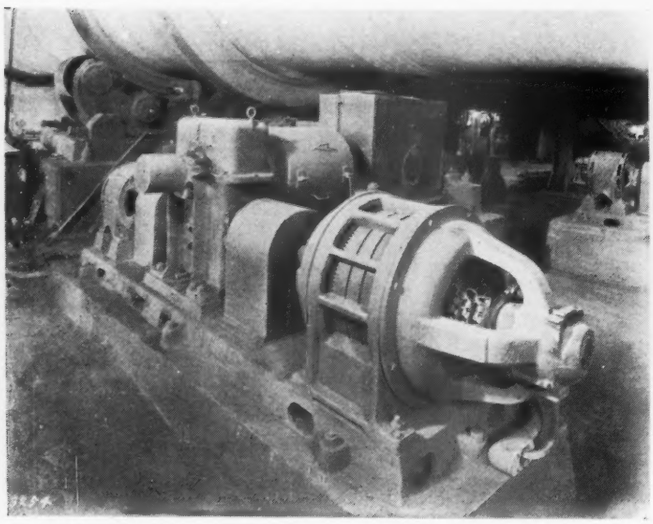


Fig. 95. Reducing gears in a cement kiln drive

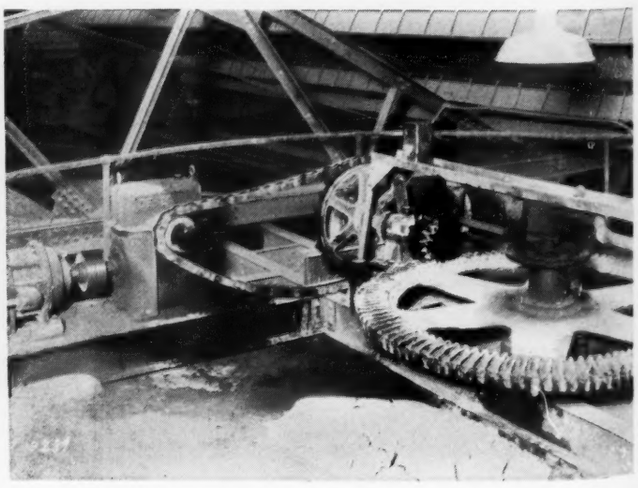


Fig. 96. Slurry agitator drive; reduction, 40:1

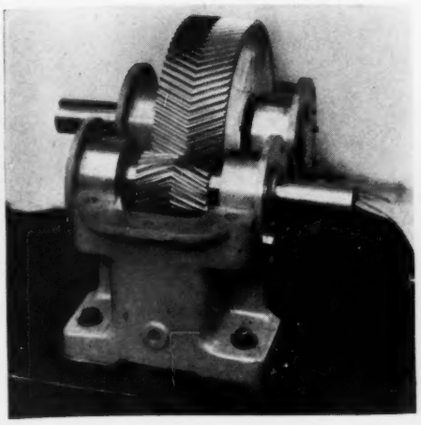


Fig. 98. Speed reducer featuring herringbone-Maag gears mounted in roller bearings

Two new V-type flexible multiple belt drives were introduced in 1929, one by the Dayton Rubber Manufacturing Co. (Rock Products, June 8), the other by Fairbanks, Morse and Co. (Rock Pbodycts, April 13).

Two new flexible couplings were described in the course of the year, one, the "Ajax" of the Ajax Flexible Coupling Co. (Rock Products, May 5), the other of the Ameri-

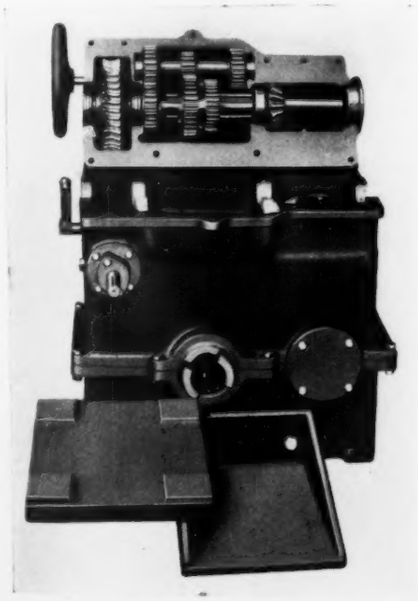


Fig. 101. Another view of the stoker drive with cover on reducer removed to show details

can Flexible Coupling Co. (Rock Products, November 23).

The Hyatt Roller Bearing Co. announced a new single row radial bearing (Rock Products, August 31).

The Goodyear Tire and Rubber Co. announces a new type of transmission belting, known as the Goodyear "Compass" endless belt. It is 25% thinner than any other belt of equal power capacity, it is claimed, and more flexible than fabric belts; the core of cords carries the load. There is no splice anywhere in the load-carrying core, and it is claimed to be as nearly stretchless as any power-transmission belt yet devised (Fig. 97). The cords are laid longitudinally and imbedded in rubber and are covered by an elastic, rubberized fabric en-

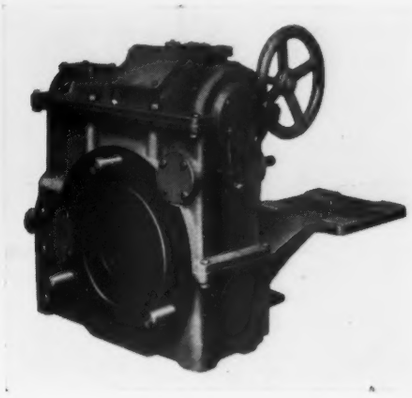


Fig. 100. A three-speed automatic stoker drive

velope. This envelope takes all of the surface wear, and is biased to make it elastic, relieving it of strain and throwing all of the load on the cords. The envelope is constructed with longitudinal ream on the edge, providing two plies of fabric on the inner or pulley ride, and giving a double resistance to wear.

Lime Plant Equipment

NOT much new made its appearance in the field of lime plant equipment and machinery. It is presumed that the status of the lime industry did not result in much encouragement. Arnold and Weigel, Inc., brought out a small size Weber hydrator, for handling a ½-ton batch (Rock Products, April 27).

H. Miscampbell, Duluth, Minn., combined his business with that of Wm. J. Kuntz, York, Penn., under the name H. Miscampbell Co., Inc., with plants and offices at both Duluth and York. This company, it is announced, will market the Kuntz plan of separation for hydrate lime by the use of centrifugal separator in connection with the Kuntz automatic beater mill, for which patents have just been allowed. By this system of separation the hydrate is discharged from the hydrator into an elevator, then to a "Whirlwind" separator, where the fines are discharged immediately to storage bins; the rejects are returned for further treatment and such rejects as are necessary, to the beater mill, and then to the hydrator, or separator, as conditions may indicate. This plan of separation is claimed to regulate to any degree the fineness of the product required or desired. By the use of the beater mill, adjustment on the plan of separation is made to provide for any degree of rejection necessary to secure the different products as called for. This system will be used in connection with the installation of the Clyde hydrator.

The Clyde hydrator, manufactured by the H. Miscampbell Co., will be equipped in the future with a Kuntz stack dust control, by an arrangement of sprays introduced into the stack of the hydrator, into which water under low pressure is introduced.

Since the amalgamation of the interests of H. Miscampbell and William J. Kuntz, the consolidation has been busy in the erection of two gas-fired lime plants, one at Spear Hill, Man., for the Moosehorn Lime Co., Ltd., the other at Swatara, Penn., for H. E. Millard of Anville, Penn. The Moosehorn Lime Co. installation will consist of four shaft kilns 11 ft. dia. by 70 ft. high, and one type SB R. D. Wood gas producer, together with the necessary buildings for the gas plant and the lime plant—all of which is of fireproof construction. Inasmuch as the plant is 150 miles from the source of electrical power supply, two Diesel engine generating sets are being installed to furnish power and light for the plant and for the town of Spear Hill. The plant at Swatara will be four kilns, 11 ft. in dia. by 60 ft. high, with the necessary kiln buildings, gas to be furnished from an R. D. Wood automatic gas producer; the plant will be entirely fireproof in construction. Each of these plants is being equipped with the Kuntz system of gas control burners.

Fig. 97. New type of power-transmission belting

Electrical Equipment

MOST of the development in electrical equipment seems to have been in control devices. In chronological order the Westinghouse Electric and Manufacturing Co. produced a new type of switch for connecting any instrument or group of instruments selectively to various circuits for metering, synchronizing, or other switching functions (Rock Products, January 5); its Class 11-200 "Deion" contactors for effective arc rupturing with greater safety and economy (Rock Products, July 20); a new series of dust-tight line starters (Rock Products, September 14); a line starter to mount within a machine (Rock Products, October 12); a new line of reversing drum controllers (Rock Products, November 9), and a detachable watthour meter for use indoors or outdoors (Rock Products, November 23).

The General Electric Co. introduced two new devices, MG-2 and PF-2, especially designed to trip the breaker in a circuit only after a suitable time interval, so as not to cause interruptions to service when momentary voltage dips occur (Rock Products, February 2); a new line of double and triple-pole temperature overload relays (Rock Products, February 16); a new manual starting compensator having a high interrupting capacity (Rock Products, February 16); a new line of radial rheostat switches for varying the fields of large electric machines (Rock Products, March 16); a new line of cam-operated, double-break and limit switches for skip hoists, car dumpers, etc. (Rock Products, April 27); a new relay for use on various types of alarm circuits (Rock Products, May 11); a small, inexpensive oil-immersed switch for use in throwing small alternating or direct-current motors across the line (Rock Products, July 6); a new design of automatic switching equipment for synchronizing motor generating sets in mining service, to occupy a minimum of space (Rock Products, July 20); a new magnetic switch for throwing small motors across the line (Rock Products, August 3); a new combination switch designed to take the place of a megnetic switch, a motor circuit switch and enclosed fuses, generally required in controlling the operation of a motor (Rock Products, August 17); a new multi-finger relay for general purpose use (Rock Products, August 31); a hand-start compensator for use in gaseous places (Rock Products, September 14); a non-glare glass for instrument covers (Rock Products, October 12); a new brazing furnace utilizing an atmosphere of hydrogen (Rock Products, October 26); a new type power and control cable with interlocked, flexible metal armor for installation without a conduit in central stations, industrial and other interior wiring (Rock Products, November 9); two new types of magnetic switches for general service starters on small a. c. motors (Rock Products, November 9); a new manual starting switch for starting relatively small motors across the line (Rock Products, December 7).

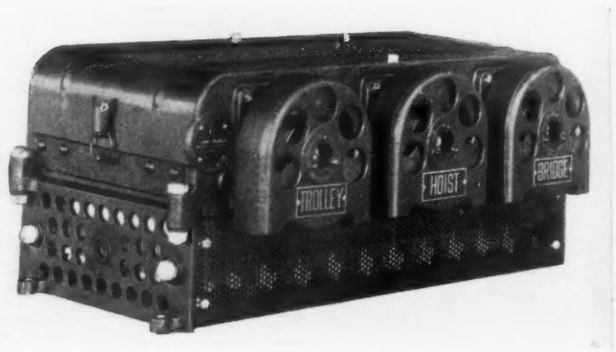


Fig. 102. New triple-drive drum controllers

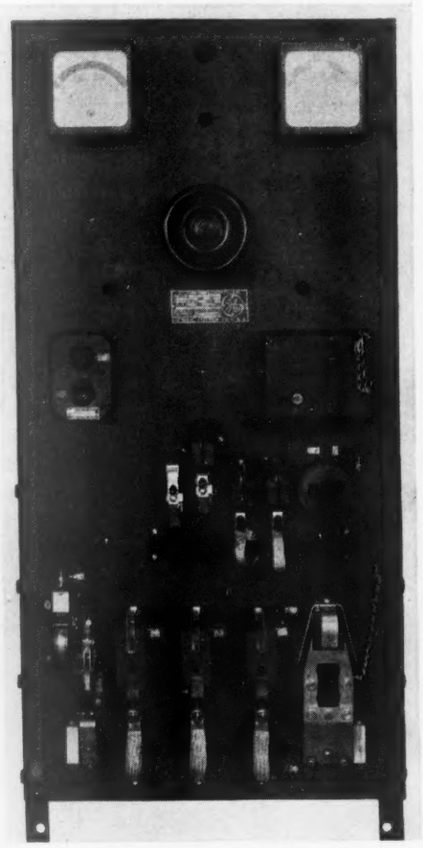


Fig. 103. Controller for synchronous motor

Other new things announced by the General Electric Co. of interest to rock product producers, include: A new self-contained triple-drum controller with a resistor mounted on the back, for the floor operation of the three motions of small, low-head cranes (Fig. 102). The general construction is similar to that of the standard G-E line, with rope wheel having a spring return, vertical or horizontal handle, all interchangeable. Another new product is a rectangular type of meter with non-glare glass and a new type of field actuating relay incorporated in synchronous motor starters, which have been redesigned. A line of semi-magnetic, reduced-voltage starters for synchronous motors designated CR-1135, and a line of magnetic full-voltage starters, CR-7065, have been revised to include the new devices (Fig. 103). The operation of the new field actuating relay, which controls the field contactor, is dependent upon

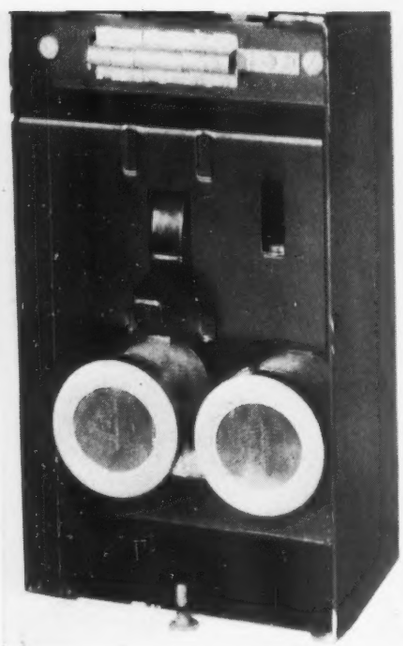


Fig. 104. Motor starting switch with overload cutouts

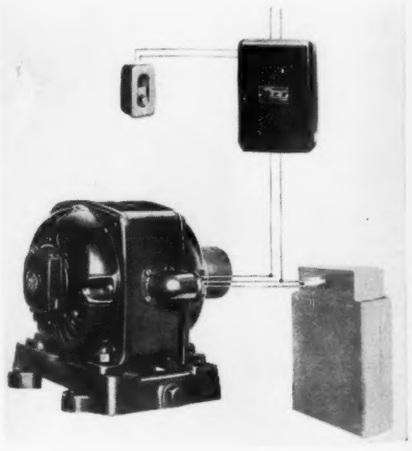


Fig. 105. New single-phase motor showing the connection to the capacitator and control devices

the speed of the motor and, in addition, a definite time delay after the motor reaches approximately 95% speed. When full voltage is applied to the motor the immediate closing of the relay contacts is prevented by a lock-out coil in parallel with the discharge resistor and energized by the voltage across this resistor.

The lockout coil holds the relay contact arm motionless until the motor accelerates to approximately 95% of synchronous speed, when the voltage across the resistor decreases and allows the lockout coil to release the timing mechanism. After the predetermined time the relay contacts close, energizing the field contactor and applying field to the synchronous motor. The closing of the relay contacts may be delayed for several seconds after the lockout coil releases the timing mechanism. This time delay insures that the motor will accelerate its load to the maximum possible speed before the field voltage is applied.

Fig. 106. Track-type limit switch, without cover, to show details

The General Electric Co. also reports important progres in 1929 in outdoor switching equipment. A new type of group-operated horizontal-break disconnecting switch was produced in ratings of 88 to 154 kv., inclusive, which is particularly applicable to isolated service. Important improvements were made in steel switchboard construction. Four single-phase 60-cycle metering equipments for 220,000-volt circuits were constructed with shielded potential elements and coordinated insulation throughout. These outfits will withstand higher impulse voltage than the line insulation. A complete new line of rectangular instruments, uniform in size and appearance, was designed for both alternating current and direct current service. These new instruments include ammeters, voltmeters, wattmeters, reactive-volt-ampere meters, power-factor meters, and frequency meters. The instruments are uniformly 6 in. high by 5½ in. wide by 3½ in. deep, thereby making it possible to mount four instruments across the face of a 24-in. switchboard panel.

The General Electric Co. further announces a complete new line of vertical induction motors in both solid shaft and hollow shaft construction. The most important economic feature of the design is the limited number of base diameters utilized, the line being so proportioned that only three base diameters are used from the 1-hp. to the 150-hp. size. This feature is of value especially to pump manufacturers and other users of vertical motors who have heretofore been obliged to make pump heads varying in size with the ratings of the motors.

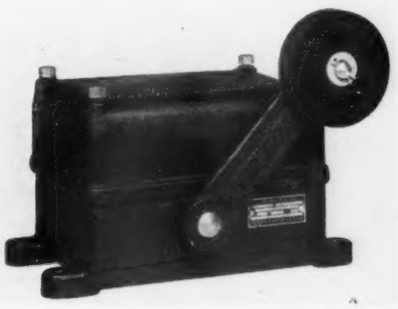


Fig. 107. New track-type limit switch

A new hydraulic operator takes the place of large alternating-current or direct-current magnets and solenoids, and may also be used to replace air cylinders where quiet and smooth upward thrust is desired through a definite distance. The device can be applied to brakes, clutches, door and window openers, hoists, small punch presses, spot welders, pumps and many other mechanisms formerly operated by solenoids and air cylinders. It consists of a motor-driven centrifugal oil pump, the impeller of which is mounted in a piston and driven by means of a spline shaft.

For installation in crane cabs, etc., the General Electric Co. announces a new type of operating mechanism for use with drum switches (Fig. 107), superseding the rack-and-pinion, under-lever type, making it possible to enclose the mechanism to keep out dust and dirt. The mechanism consists of a pinion on an extended drum switch shaft, meshing with a segment gear, all housed in a dust-tight cast case provided with plugged access hole for gear slushing and with a short lever arm projecting below the case. The lever arm can be connected with the reach rod in the same way as with the old rack-and-pinion type.

A recent publication of the General Electric Co. on synchronous motors will be found particularly helpful to rock products operators, since this type of motor has a wide application in this industry and its use very favorably affects the plant's power factor. This was brought out in an article by W. C. King on "Synchronous Motor Drives for Gyratory Crushers," (Rock Products, November 9).

The Crocker-Wheeler Electric Manufacturing Co. brought out a combination of motor and speed changer without the use of base or coupling, which is claimed to have advantages over other methods of power transmission (Fig. 108). The speed changing device employed depends upon the principle of "adhesion." Especially heat-treated rollers are employed in these speed reducers, and the force of adhesion by which they drive is automatically attained so that no slip occurs, even with the severest overloads and shock conditions, it is said. By this means, the advantage of low speed drive can be obtained, with the good electrical performance of standard speed motors. This is of particular advantage for induction motor applications. The efficiency of the speed reducing mechanism is claimed to be high—over 98%—and it retains its initial high efficiency throughout the life of the mechanism, which is equal to that of the motor itself. Powers are available up to 30 hp. with ratios of reduction up to 10:1.

The Cutler-Hammer Co. developed a series of dust-tight enclosures for motor starters (Rock Products, September 28); a new d. c. across-the-line starter (Rock Products, October 26), and recently announced a new d. c. counter E. M. F. automatic starter for small motors, incorporating a number of new features, such as small size, reduced voltage starting, thermal overload protection, low voltage protection and renewable silver contacts. It is rated up to 2 hp., 115 or 230 v. The Lincoln Electric Co. introduced a new safety-type push button (Rock Products, November 23). The Electric Controller and Manufacturing Co. brought out a new system of electrical control designated "time-current control" (Rock Products, May 25). The Wagner Electric Corp. brought out a new rubber-mounted motor for ultra-quiet operation (Rock Products, June 22).

The Luth and Rosen Co., a Swedish concern, introduced in this country a line of motors with built-in speed reducers (Rock Products, March 16).

Fig. 108. Combination of motor and speed changer without base or coupling

Cement-Mill Machinery and Equipment

THE development in cement-mill machinery and equipment has been notable, and emphasizes, as brought out in our review of the portland cement industry the renewal of the age-old controversy of wet vs. dry process.

F. L. Smidth and Co. say that results with their Unax kiln, equipped with the latest type of Unax cooler and their patented chain system in the drying zone, prove to their satisfaction that it is possible to obtain a fuel economy from the wet-process kiln equal or better than the fuel economy from the average dry-process kiln—which has been the chief if not the only drawback to the wet process. Installation of this chain system in many existing kilns is said to have resulted in fuel savings as high as 20% of the amount of fuel used prior to the installation of chains. Another feature this firm has found to be of great advantage in getting the best economy from rotary kiln installations is a centralized control system, which has been noted in the descriptions of new plants designed by F. L. Smidth and Co., published in Rock Products during the year. It is difficult to estimate in dollars and cents the advantage of the centralized kiln control. However, the instruments are a great help to the kiln operator in getting the highest possible efficiency with his kiln. Furthermore they furnish the superintendent with complete information concerning the operation of the kiln during the different shifts and give him, thereby, an excellent check on his men. It is well known that a careless and unreliable kiln operator is able to cause a very considerable loss to his company in the way of too low output, too high fuel consumption and damage to the kiln lining; therefore, the more the operation of the kiln be under instrument control the better results will be obtained.

F. L. Smidth and Co. state that experience with their Unidan finish compartment mill, which has several patented features, has proved very satisfactory. Some of the special features are a screening compartment which is claimed to give it great flexibility for grinding materials of different finesess and a cooling arrangement which increases grinding efficiency at the same time it decreases the temperature of the cement.

The Allis-Chalmers Manufacturing Co. reviews cement-mill machinery developments in 1929 as follows: "In conection with rotary kiln design, the enlarged calcination zone, the advantages of which were enumerated in last year's review, has been furnished on several kilns, and according to reports by the operators, the kilns provided with the enlarged calcination zone are producing a superior grade of clinker. Rotary kiln driving mechanisms have been improved by the addition of another set of roller bearings, which now make this unit an all grease lubricated design. The first shaft from the high speed end of this mechanism has been mounted on roller bearings for some time. There has been a marked increase in the sale of rotary dryers, and one of the most notable advances in rotary design is exemplified in a 6-ft. by 48-ft. direct-heat, oil-fired dryer manufactured for the phosphate industry in Florida. This dryer was equipped throughout with roller bearings, the carrying mechanisms as well as the driving mechanisms being fitted with anti-friction type of bearings.

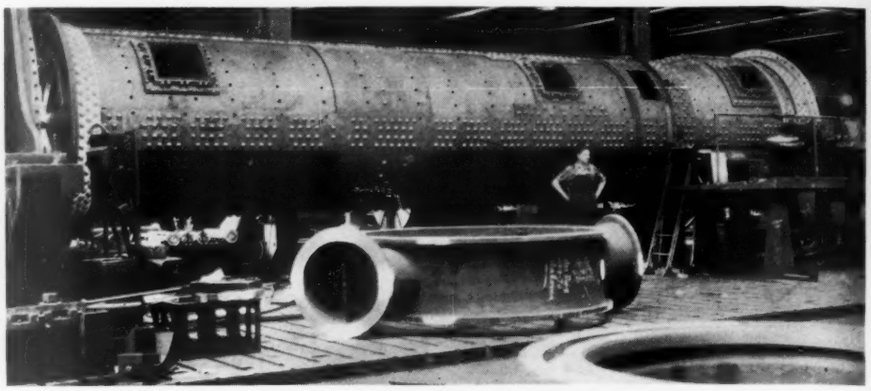


Fig. 109. A 40-ft. by 8-ft. by 7-ft. three-compartment compeb mill with one-piece longitudinal buttstraps, full length

"The success of the Compeb mill division head with peripheral screen and return scoops has been fully demonstrated on the new mills now in operation. Several existing mills are now being fitted with this same type of outside screen and return scoops. The division head with peripheral screen and return scoops has been simplified by keeping the rejection return scoops outside of the housing, the material being collected for introduction to the scoops by means of an annular shaped pocket constructed at the end of the screen and revolving with the mill and scoops. The latest Compeb mill shell design calls for the construction of single diameter shells, one plate for the entire length, four to the circle. For two diameter shells the enlarged diameter and taper section are combined longitudinally in one plate, four to the circle (Fig. 109), which the reader will observe permits the use of continuous longitudinal buttstraps for the entire length of the mill. The following sizes of concavex are now being made of forged steel as well as cast iron: 1¼-in. concavex, ⅞-in. concavex, ¾-in concavex. The volume of forged steel concavex business has increased so greatly that additional equipment has been added to facilities for manufacturing this patented grinding media."

The Traylor Engineering and Manufacturing Co. reports many interesting installations, particularly the 365-ft. kiln on six single-roll supports for the Hull plant of the Canada Cement Co., Ltd., the longest kiln yet installed in North America. One of the roll supports is fitted with double thrust rolls, with Timken roller bearings throughout. The principal features of this type of kiln were described in detail in Rock Products Annual Review issue a year ago. A new product of the Traylor company in 1929 was a slurry feeder. This feeder is entirely self-contained and fully enclosed consisting of a disc to the side of which are bolted a number of cast-iron buckets, which are adjustable to regulate this discharge into the funnel which conducts the slurry into the kiln. The bucket wheel operates in a steel tank fitted with suitable inlet, overflow and drain pipes, and the tank is enclosed in a steel housing fitted with a hinged inspection door. The wheel is driven by worm gears, from a high speed electric motor through a flexible coupling or it may be operated by chain drive from the shaft of a roller support of the kiln. The entire feeder is mounted on a heavy base plate which has an extension to carry the driving motor. The Traylor slurry feeder is made in two sizes—with 36-in. bucket wheel having a capacity of approximately 100 bbl. per hr. and the 54-in. for 200 bbl. per hr. (Fig. 110).

The Traylor company reports an intensive study and exhaustive experiments in finish

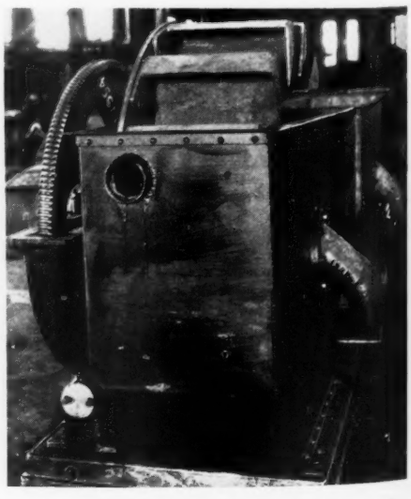


Fig. 110. New bucket-wheel cement slurry feeder

grinding to help meet the growing demand for high early strength cements, the result of which is a new improved three-compartment mill, the main essentials of which were described in our Annual Review issue in 1928.

The Hardinge Co., manufacturers of the Hardinge conical mill, announces a new regulating feeder, which eliminates variations in feed due to changes in size of material, moisture content and specific gravity. The Hardinge "Constant Weight Feeder" regulates by weight rather than volume. This feeder automatically maintains the weight constant, no matter how conditions change, it is claimed. A traveling belt, attached to a frame on which the driving mechanism is also located, is suspended so that any variation in the weight on the belt moves the frame, which in turn moves the feed gate. When the weight increases, the belt frame lowers and the gate shuts slightly, thus reducing quantity of feed. If the weight decreases, the belt and frame rise, opening the gate and increasing the quantity of feed. A balancing weight controls the quantity desired and a revolution indicator makes it possible to record the weight for any given period. The feeder is a self-contained unit and no auxiliary driving mechanism is required. The application of this device is manifold. Several of these feeders set to deliver a constant weight of various materials make a proportioning device for various uses. By means of a remote control device, the feed can be varied at will any desired distance from the feeder itself. It can be used for proportioning raw mix in cement plants, etc. Its capacities range from 200 lb. to 100 tons per hour (Fig. 111). The Hardinge Co. also developed a new type of lining for the conical mill. This is the "Depression" liner, which is made with beveled edges in order to form a depression between each plate. In this depression is located a small metal plate, to prevent wear on the mill shell. The depression thus formed increases the rapid circulation of balls and material, which affords greater grinding action for the power expended. Less mill volume is used, thus increasing the grinding volume available. Very little change in contour of the liner has been noticed as a result of wear, it is claimed. Therefore, the grinding efficiency of the mill is maintained at a maximum throughout the life of the lining. On dry grinding mills, the life ranges from 4 to 10 years, and on wet grinding mills from 9 months to two years, it is said.

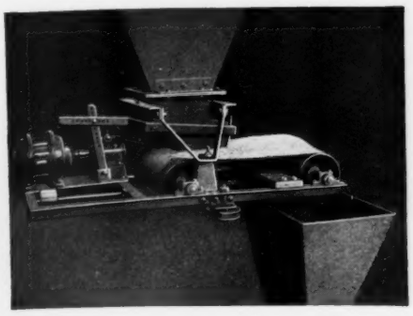


Fig. 111. Automatic regulating feeder proportions material by weight

Fig. 112. Liner for conical mills which is made with beveled edges to form depressions between plates

Fig. 113. Paddle grate for wet grinding mills

The Hardinge paddle grate has been recently developed to increase the efficiency of wet grinding Hardinge mills. This grate is in the form of four perforated scoops or paddles located in the discharge end of the mill. As the material discharges from the mill, it is swept by these paddles, which revolve with the mill, and therefore travel much faster than the pulp flows. The finer material passes through the screens and out the mill. The oversize rolls into troughs attached to the bottom of the paddles and is thrown back into the mill for regrinding. The pulp is screened, but not impeded in any way as it passes through the grate zone. The screen is self-cleaning, and the grate frames can be removed in a few minutes from the discharge trunnion. Replacement balls can be introduced through the discharge end as the grate immediately feeds them back into the mill. A low pulp level can be maintained by using large discharge ports. A high pulp level is secured by using a restricted discharge spout. Operation with and without the grate shows an increase in tonnage with lower ball and lime consumption in favor of the grate, especially when operated in closed circuit with a classifier for fine grinding, it is claimed.

The Bradley Pulverizer Co. reports that during 1929 it confined its efforts to improving small details of the "Bradley Hercules" mill. Among the outstanding improvements was the use of hard metal coated rolls and die rings, using such materials as Stoodite and Stellite, and found the application of these metals to work very satisfactorily, and reduced the maintenance cost of the operation of this type of mill. Many other details of the mill have been changed, but they were simply the usual evolution of improvements.

Among the new uses mentioned for Bradley machinery is the use of the "Griffin mill" among stone producers, who are producing rock dust for the dusting of mines.

A new type of slurry filter, that is new to the portland cement industry, made by the Filtration Engineers, Inc., was described in Rock Products, June 8. Arthur Wright, president of the Filtration Engineers, Inc., manufacturers of this "FeInc." slurry filter, states: "We have found some slurries on which we do not recommend filters. Wherever the colloid content is such that the dewatering effect on the filter is poor, that material is better handled in the wet slurry form. Fortunately for the cement industry the number of such slurries is very small. It would, however, be unfortunate for the industry to gain the idea that all slurries are filtrable, or that all filters are applicable. Actual tests on the slurries should be obtained and from such tests the conscientious experimentor will report on the advisability of applying filters or continuing to feed wet slurry."

The Oliver-United Filters Co. made several notable new installations in the course of the year, which are noted elsewhere in the review of the portland cement industry.

The Sturtevant Mill Co. has taken the lead in the development and installation of closed-circuit dry grinding of raw materials. Many noteworhty installations were made in 1929 and a great deal of invaluable experience and data accumulated in dealing with various raw materials and various operating conditions. It is pointed out that the mere installation of air separators is not the universal solution to the problem of closed-circuit grinding. It is the control of particle size best suited to the conditions and for most efficient chemical action in the kiln, for both kiln capacity and quality of cement. In other words there are numerous variable factors, more or less different in each mill, which must be taken into con-

sideration. To meet the mechanical solution of the problem the Sturtevant company has developed an improved, adjustable air separator for separating products up to 99½% passing 350-mesh. More in regard to these separators will be found under "Air Separators."

The Fuller Co. has just announced its purchase from the Guarantee Construction Co., New York City, of the "Airveyor," an air conveying device that picks up its load by suction. It is intended to use this in connection with the extension of the Fuller-Kinyon system of pumping cement and other dry pulverized materials. The Fuller-Kinyon system, with which our readers are familiar, requires the material to be fed into it. It does not pick up materials. Hence the "Airveyor" supplies the "missing link" to make a complete pneumatic loading or unloading device. The Fuller Co. made many new installations during 1929, some of which have been referred to during the year in published descriptions of new plants.

A new system of coal drying, utilizing the waste heat from the exterior of the shell of rotary kilns, developed by Jones and Hartman, Inc., was described in Rock Products, June 8.

Air Separators

THE OUTSTANDING development in air separation in 1929 was its successful adaptation in closed-circuit, dry grinding of raw materials in the portland cement industry, referred to elsewhere in this issue.

To meet the needs of an air separator for this purpose the Sturtevant Mill Co. has produced a new improved, adjustable air separator giving products to 99½% passing 350-mesh, it is claimed; they also will operate successfully, it is claimed, on materials as coarse as 30-mesh, but not on very heavy materials. The improvements recently made are in design for enormous circulating loads, as high as 150 tons per hour, in proportions to allow efficient work with such loads, in inclination of cones to allow free flow of material, in greater structural strength to prevent distortion, should the separator fill with material and thus act as a bin; in flexibility and precision adjustment to allow quick and accurate modification of product; in bearings and drives to compensate for the necessary power for such heavy duty loads; in special linings to resist wear. In its application the entire principles of pulverization are said to be changed, the separator now, and not the pulverizer, is entirely responsible for the fineness of the product. The mill now is required to grind only at greatest speed, and it is claimed to matter little whether its output contains 10% or 90% of the product desired; it is the amount of finished product ground and taken out by the air separator per hour that counts. Therefore it is held that great circulating loads result in enormous capacity increases at correspondingly low costs, and quality, or fineness of output, is a matter only of separator adjustment.

The Raymond Bros. Impact Pulverizer Co. also announces a new separator (Fig. 114). In the operation of the separator the product is fed on to a distributing wheel or disc which throws the material over the edge and across the air space between the disc and the inner cone of the separator. At the same time the fan in the top of the separator creates a large volume of circulating air which travels down between the inner and outer cones, entering the inner cone through the deflector doors. At this point it starts to go through the dropping material. The construction permits of the use of a very large volume of air to assure the picking

Fig. 114. New air separator

up of all particles, it is claimed. The selection of the proper size material is made by a patented arrangement which literally knocks out of the air current the oversize particles. This cuts down the amount of fine dust which ordinarily would be discharged to the tailings and makes the separation much more efficient, it is said. It also makes it possible to obtain uniform fineness from the separator regardless of the variation in the mill grind. The Raymond mechanical separator may be installed in conjunction with almost all types of mills, such as hammer, tube roller, ball, attrition, beater, etc. The operating mechanism is simple in construction and positive in action, it is claimed. All moving parts of the separator are accessible and large access doors are so placed as to make inspection easy.

The Rupert M. Gay Co. reports no startling changes in the construction of its "Gayco" separators, except that it is building them in constantly larger sizes—up to 16 ft. at present, and these for the portland cement industry.

During the year Rock Products (June 8) published a new method of separating asbestos fiber from matrix developed by the Hardinge Co., utilizing air separation.

Scales—Aggregate Meters

THE increasing demand for accurately proportioned concrete aggregates is leading to more and more interest on the part of progressive producers in weighing devices for batching. The Erie Steel Construction Co. brought out a new volume weighing "AggreMeter," which proportions aggregates either by weight or volume (Rock Products, March 16). The same company placed on the market a portable steel bin especially designed for use with its AggreMeter (Rock Products, April 27). The latest addition to the Erie line is an AggreMeter plant especially designed to load the various types of mixer trucks (Fig. 115).

These new plants are built in two, three or more compartments of 25 tons capacity and up, for loading ½ to 3-cu. yd. trucks. The smaller type plants are shipped from the factory in two main sections and one top section, while the large sizes are shipped in large sections which are easily erected. The unit consists of a self-cleaning bin, a self-clearing AggreMeter and a floating charging hopper. Each material is weighed on a separate beam and an auxiliary dial

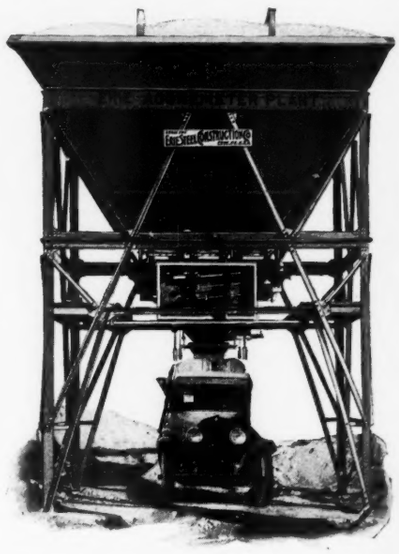


Fig. 115. Batching plant designed to load mixer trucks

shows the approach of the desired weight. Hand wheels control the operation of the bin gates; a trip rope opens the draw-off door which closes automatically. The floating charging hopper is designed to prevent spillage. A different type is used for end loading. It can be moved out of the way for direct loading into trucks. Designs are furnished for holding, proportioning and adding the cement when it is desired to do this at the batching plant.

John Chatillon and Sons developed an automatic scale for continuous weighing of materials in transit (Rock Products, August 3).

Cutting and Welding Equipment

SEVERAL new things in cutting and welding equipment were noted in 1929, both for electric and oxy-acetylene outfits. In chronological order these were: Improved welding gloves by the Oxweld Acetylene Co. (ROCK PRODUCTS, January 19); a new 300-amp. electric arc welder by the Lincoln Electric Co. (ROCK PRODUCTS, February 2); a new line of light welding torches by the Oxweld-Acetylene Co. (ROCK PRODUCTS, March 2); an "electronic tornado" welder for welding small tanks, by the Lincoln Electric Co. (ROCK PRODUCTS, June 8); a portable gas-engine-driven arc welding machine by the Fusion Welding Corp. (ROCK PRODUCTS, August 3); a new medium-pressure acetylene generator, by the Oxweld Acetylene Co. (ROCK PRODUCTS, August 3); an electrode holder, by the Lincoln Electric Co. (ROCK PRODUCTS, August 31); an improved bronze welding rod, by the Oxweld Acetylene Co. (ROCK PRODUCTS, August 31); a new welding rod of manganese-chrome-iron, called "Hascrome," a self-hardening alloy, by the Haynes Stellite Co. (ROCK PRODUCTS, November 23).

In addition to the above the Lincoln Electric Co. incorporated several new features in its "Stable-Arc" welders, designed for unification of the controls of both motor and generator. The same company produced an entirely new type of water-cooled carbon electrode holder.

The General Electric Co. has recently brought out a new portable electric arc welding machine (Fig. 116) driven by a 6-cylinder gas engine, replacing a 4-cylinder engine unit previously made. The new engine is a Buda Model HS-6 of 39 hp. at 1440 r.p.m. The engine is totally enclosed in a sheet-metal housing. The generator is a bal-bearing, self-excited, single-operator machine rated at 300 amp., 1 hour, 50 deg. C. with a current range of 90 to 375 amp. Included with the set is a curent-reducing resistor by means of which welding currents down to 25 amp. may be obtained. The current can be adjusted by turning the brush shifting handle. A 500-amp. ammeter and a 120-volt voltmeter are mounted on the generator panel. A self-adjusting, stabilizing reactor automatically steadies the arc. The automatic regulation is obtained by a specially designed magnetic circuit without any moving parts. The complete outfit is mounted on a welded structural steel base and may be made portable by the addition of running gear. For outside work a canopy is provided to protect the generator from the weather.

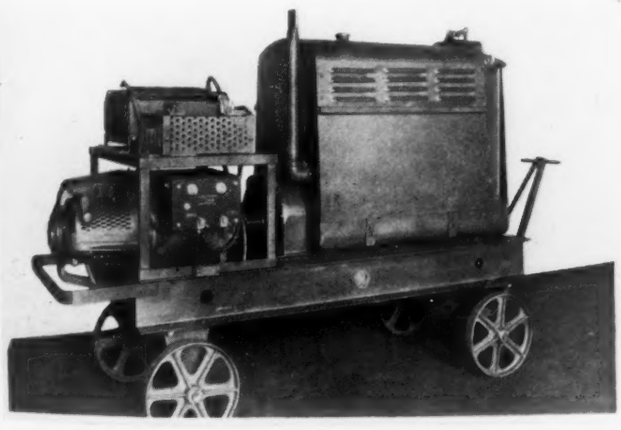


Fig. 116. Gas-driven, portable arc welding machine

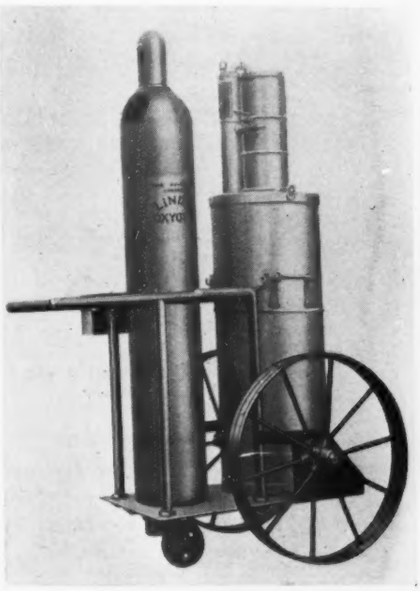


Fig. 117. Three-wheeled truck carries acetylene welding accessories

The General Electric Co. also announced during the year a clamp type electrode holder. This device has jaws of heavy copper alloy, notched to hold firmly any size of electrode wire from 1/16 to ¼ in. in diameter, in any position. A molded compound handle protects the operator from heat and from contact with current-carrying parts. The holder is designed for use with currents up to 300 amp.

The Oxweld Acetylene Co. has recently introduced two new types of trucks to accommodate Type CLP-3 and Type CLP-2 "Carbic" low-pressure acetylene generators, respectively (Fig. 117).

The truck designed to carry a CLP-3 carbic generator also carries two cylinders of oxygen. Two large wheels carry the back part of the truck; a third wheel, in the front, is of the castor type and allows the truck to be turned in a radius about equal to its own length. The generator is secured to the steel deck of the truck by means of angle iron braces and two long bolts which are inserted in the handles of the generator and tightened by means of turnbuckles. The truck is provided with a steel tool box with loop fastenings. This box can be used for wrenches, small tools, or for a welding or cutting outfit. The oxygen cylinders are chained to a steel rack which is fastened to the deck of the truck beside the generator. A crane is provided to be used in charging and emptying the generator. The water and residue can then be drained off through the outlet at the bottom. The crane jib is made in three sections which can be telescoped when not in use to decrease the height. The truck has two 24-in. steel wheels with 3-in. tires, and a castor wheel which is 12 in. in diameter by 2 in. All wheels are provided with grease cups for lubrication.

The smaller truck will accommodate one cylinder of oxygen in addition to the Type CLP-2 carbic generator. It is designed for extreme portability and can be wheeled anywhere with ease. There are two 25-in. steel wheels and one 5-in. caster wheel operating on a roller bearing. All wheels are provided with grease cups for lubrication.

Owing to the increasing use and applications of atomic hydrogen arc welding, a portable self-contained equipment was developed. This equipment is mounted on a small truck by means of which it may be readily moved by one man. All that is necessary to place the equipment in operation is to connect the equipment to the source of a. c. power by means of two wires.

The General Electric Co. increased its line of welding electrodes by adding Types H, L and M to its already well known line of Types A, B and F. Type H is a solid wire electrode with a light coating of flux and is characterized by a strong, stable arc, and a rapid melting rate at high current densities, thus assuring high speed in welding. Type L is a plain sullcoated wire, moderately priced, and with exceptionally good welding characteristics. Type M is somewhat similar to Type F, but is recommended where exceptionally sound and ductile welds are required. It has a relatively slow fusion rate and is therefore of value where deep penetration is required. Standard sizes of all types are 3/32 in., ⅛ in., 5/32 in., 3/16 in. and ¼ in.

Air Compressors

THE Chicago Pneumatic Tool Co. is announcing a new type vertical, duplex, single-acting compressor, Type P6-DE (Figs. 118, 119), supplementing its extensice line of horizontal, double-acting compressors of larger capacities. The new type compressor is made in sizes 100 to 310 cu. ft. Cylinders are water-jacketed; the inlet and discharge

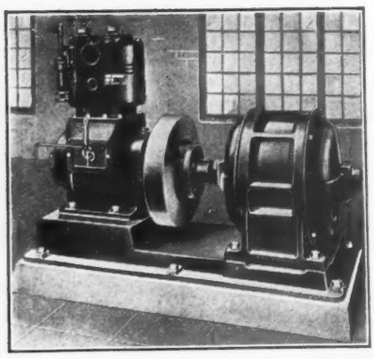


Fig. 118. New type of vertical, duplex single acting air compressor

valves are of the standard "Simplate" design, especially adapted to high speed operation; the lubricating system is entirely automatic. The cylinders are equipped with unloading inlet valves which, in combination with a "Simplate" unloader, control the quantity of air delivered by opening the inlet valves of the compressor and allowing the air drawn into the cylinder to return to the atmosphere whenever the receiver pressure reaches the maximum pressure desired. When the demand for air increases, causing a drop in pressure, the unloader allows the inlet valves to close, and compressor at full capacity is resumed. The motor-driven compressors can be equipped with automatic start-and-stop control.

The Ingersoll-Rand Co. also is announcing a new line of small air compressors, known as Type 30 (Fig. 120), air-cooled, two-stage, with V-type belt drives. The units are self-contained, the motor and compressor being mounted on a steel base, which is attached to the top of the air receiver. The latter, which is made of heavy pressed steel, is built to withstand a working pressure of 200 lb. The intercooler is located behind the fan-type flywheel, and a constant current of circulating air is driven directly across the cooling coils. This reduces the temperature of the discharge air. Automatic start and stop control, furnished as standard equipment, operates independently, but in conjunction with the unloader. When the pressure in the air receiver reaches a point at which the regulator is set to unload, the motor is automatically shut off. A centrifugal governor allows the air in the high-pressure cylinder and intercooler to exhaust through the crankcase. This prevents the compressor from starting against a load. A self-cleaning air cleaner keeps dirt out of the compressor. It is built in four sizes: ¾-, 1½-, 3- and 5-hp.

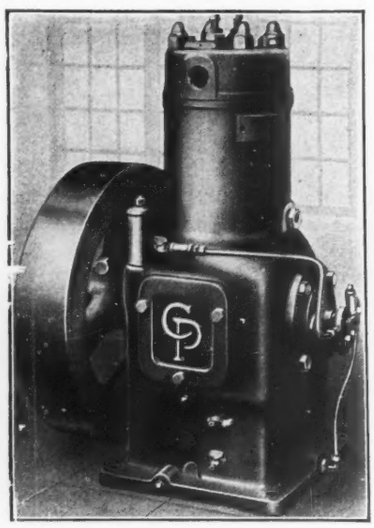


Fig. 119. Gasoline-driven type of air compressor shown in Fig. 118

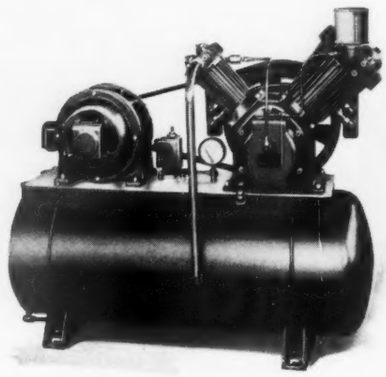


Fig. 120. Air-cooled automatic start and stop air compressor

The Pontiac Tractor Co. produced a new four-wheel, self-propelling air compressor (Rock Products, January 19). The Worthington Pump and Machinery Corp. produced a new line of compressors ranging from 100 to 300 cu. ft. capacity, equipped with Timken roller bearings (Rock Products, September 14).

Power Accessories

THE Combustion Engineering Corp. developed a simple device permitting the placing of water-level indicators at any desirable point (Rock Products, July 20).

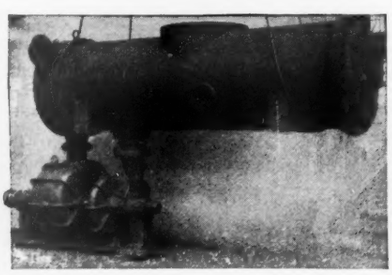


Fig. 121. Unit type surface condenser

Arnold and Weigel, Inc., produced an improved small stoker for boilers (Rock Products, August 17). The Combustion Engineering Corp. developed an electric drive for underfeed stokers (Rock Products, August 31). The Westinghouse Electric and Manufacturing Co. developed a unit type surface condenser (Fig. 121). The circulating and the condensate pumps are attached directly to and are located underneath the shell of the condenser. The complete unit is placed beneath the prime mover which it serves; thus a minimum amount of space is required for its installation. By locating the condenser inside the prime mover foundation, the expense for foundation work is minimized and building costs are correspondingly reduced.

Cement Products Machinery

NORRIS K. DAVIS placed on the market an interesting plaster and mortar mixer, combined with a portable hoist (Rock Products, July 6). The Besser Manufacturing Co. extended its line of automatic tripper block machine (Fig. 122). They are now made in three standard sizes, 8 blocks per min.; 6 blocks per min. and 4 blocks per min. Besser mixers for products plants are now made in sizes ranging from 5 to 42 cu. ft. A new piece of equipment is an automatic brick machine for 50,000 concrete brick per day which can be used for making double brick, 5-in. high. The new mixers are equipped with guarded Texrope drives.

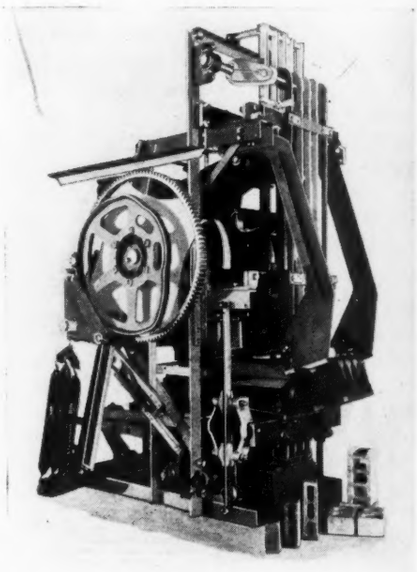


Fig. 122. New automatic block machine

Nickel-Steel Castings

THE EFFECT of castings of nickel-chromium as contained in Mayari pig iron is very clearly brought out in two articles by Dr. Richard Moldenke which have been incorporated in a little booklet published by the Bethlehem Steel Co. This information as well as a general description of the properties of Mayari pig iron is now available to interested parties.

Measuring, Indicating and Recording Instruments

THE cement, lime and gypsum industries are each year becoming better acquainted with heat measurements and their utilization. In new plants in the cement industry the installation and grouping of control instruments at the kiln-burners platform is mute but convincing evidence of the gradual elimination of the human element, so long considered necessary to successful clinker burning. Probably indicating and recording instruments found their way into cement mills via the waste-heat boiler power plant.

The Brown Instrument Co. announces that with the steadily increasing steam pressures a special manometer, Model 254 (Fig. 123), was designed for use under pressures not

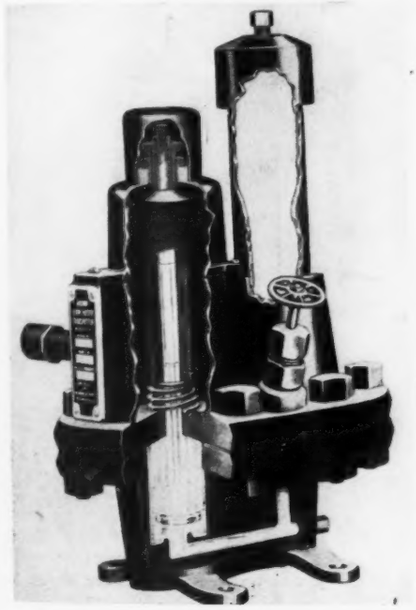


Fig. 123. High pressure manometer

exceeding 1500 lb. per sq. in. This manometer utilizes the same range of mercury differentials as the standard manometer, Model 253, and the same indicating, recording and integrating meters can be used in parallel with it. Like the standard manometer, all stuffing boxes and electrical connections in the pressure chamber of the manometer are eliminated. This manometer, which is essentially a mercury filled U tube, is made of forged steel in two parts. Connection between the two parts made by means of a tongue and groove joint. This type of joint permits the use of a narrow gasket with very high gasket pressures, and also decreases the possibility of the gasket blowing out, due to it being held in place by the walls of the groove. The bolts joining the two parts are of ample size to give a sufficient factor of safety. The manometers are placed under a 2500-lb. pressure test for a period of six hours. The high pressure and low pressure connections are made of ½-in. extra heavy pipe size seamless steel tubing. The equalizing valve which is located in the manometer has a Monel Metal stem and packing gland. This valve is of the needle type and eliminates any possibility of leakage between the high and low pressure sides of the manometer.

There has been an increasing demand for the continuous or strip chart recorder. This is especially noticeable where not only the record but also control of flow is desired. With the increasing use of instruments in greater numbers, a growing interest in the appearance of the instrument installation has stimulated a demand for flush type instruments. Responding to thos demand, Brown electric flow meter recorders were this year made available in the flush type (Fig. 124).

The greatest objection to the flush type instrument has been the inaccessibility of the internal parts. This has been eliminated by mounting the entire mechanism on a carriage which can be drawn out from the case, as shown in the cut. With the recording mechanism drawn out, the changing of chart rolls and inspections are easily made. If it is necessary to inspect the interior, the removing of two screens allows the entire recording mechanism to swing to the left, exposing all of the interior. When in an operating position, a locking device holds it firmly in place.

This meter can be supplied as a single or duplex recording instrument. Types available record flow, two flows, flow and temperature, or flow and pressure. It can also be equipped with a chart re-roll when monthly records are to be kept as one continuous record. It is also supplied as an automatic controller, for the flow of air, gas,

Fig. 125. Remote type recording instrument

per hour, and a single chart is sufficient for 30-days record.

During the latter part of 1929 the Brown Instrument Co. has brought to completion the development of a new line of instruments for indicating, recording and controlling various factors at long distances.

Ordinary pressure gages, for instance, are not designed to work effectively at very long

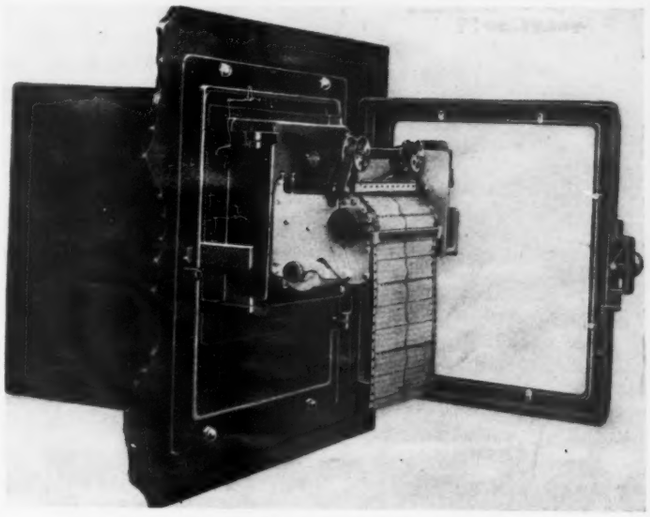


Fig. 124. Flush-type electric flow meter

water, oil or steam. The chart speed is 1 in. range. Yet for many purposes there exists an urgent need of instruments that can be relied on to indicate, record or control pressures and other factors dependably over distances of several hundred feet and up to 30 miles. Brown remote type instruments were developed to meet this need. (See Fig. 125.)

All of these instruments are made to operate on the inductance bridge principle, adapting this method of transmitting motion to use with various elements in the respective instruments in such manner as to transmit impulses properly corresponding with the fluctuations in the factor to be indicated, recorded or controlled. The line now includes instruments for indicating, recording or controlling at long distances, pressures, flows, liquid levels or special data involving the position or motion of a member or element requiring observation or control at a distance. The latter applications are taken care of by the adaptation of the Brown motion transmitter, a new instrument belonging to this remote type line.

The General Electric Co. notes that in the measurement of temperatures by means of thermo-couples, it is necessary to have the equivalent of a fixed temperature of reference. In a new instrument this equivalent is supplied by the use of a temperature-sensitive magnetic counter-torque in addition to the ordinary spring control. This instrument will be particularly useful in numerous applications of temperature measurement where the measuring apparatus, as distinguished from the thermo-couple itself, is likely to be subjected to a wide range of temperatures.

"Calmaloy," the magnetically temperature-sensitive material used for temperature correction in watthour meters, is the material used and is the key to this form of temperature measurement.

Alloys and Special Metals

THERE was a very decided tendency in 1929 to introduce new wear and temperature resisting alloys in machinery and equipment used in the rock products industry—more evidence of the progres being made to reduce costs of operation even in the smallest details of plant equipment. The Fuller-Lehigh Co. produced "Elverite," a new grade of chilled cast iron (Rock Products, August 17).

The American Manganese Steel Co. considerably extended its line of manganese-steel castings, some of the new products being "Amsco" crawlers for power shovels (Fig. 126), part of the largest (16½-yd.) clamshell bucket ever built; an 8½x41-ft. pan feeder; a single casting for the mantle of a 54-in. gyratory crusher—this single casting weighed over 12 tons and is one of the largest manganese-steel castings ever made; a 15-in. sand and gravel dredge pump.

The J. S. Morrison Co. produced a new ferrous metal called "Meehanite," having greatly increased strength and wear resistance under conditions of both heat and acid. The metal, though not an alloy, is of very close grain and can be cast and used without heat treatment. It is said to retain with increased degree all of the inherent desirable characteristics of cast iron. Due to the fact, however, that the carbon, instead of being in free graphitic flakes, is broken down into small nodules surrounded by ferrite, physical specifications are obtained in the cast steel range. Physical results are obtained entirely by mechanical means of breaking down the free graphite into nodulated form and changing the cementite into pearlite and graphite. This metal contains about 95½% iron compared to 94% for semi-steel and 93% for ordinary cast iron. This metal is said to offer unusual resistance to abrasive wear and not to chip, spawl or flow under impact or shock. It is claimed that the metal in general will show tensile strength over two times that of the best grade of commercial gray iron and considerably higher than most alloy irons. Transverse test will run at least twice ordinary commercial gray iron. The elongation of this metal is one of its outstanding characteristics among ferrous metals.

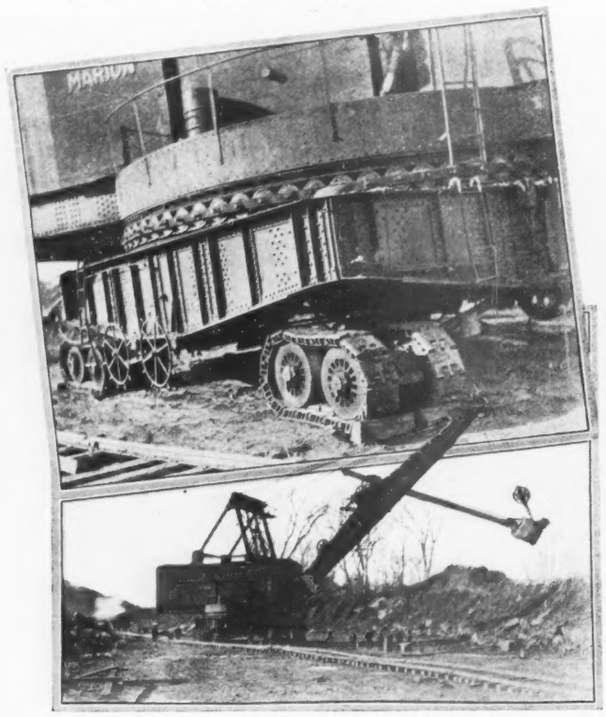


Fig. 126. Manganese steel crawlers on a power shovel

The Farrell-Cheek Steel Foundry Co. states that it had to increase its production 500% to take care of increased demand for its "Farrell's 85," much of which demand came from the rock products industry.

The National Malleable and Steel Castings Co. produced "Nurex" metal for use as a high grade grinding media in ball, tube mills, etc. It is an electric furnace product.

Flood Lighting

THE General Electric Co. announced a new line of flood-lighting projectors (Rock Products, November 23); Fairbanks, Morse and Co. brought out a new small portable lighting plant for auxiliary service, of 750 to 1500 watts capacity, motored by 1½ to 3-hp. gasoline or kerosene engines (Rock Products, December 21).

Sand-Lime Brick Machinery

THE Jackson and Church Co. announces a new drive for its sand-lime brick press, so that it is now driven by a single motor placed on a bracket at the rear of the press (Fig. 127). The motor and press are connected by a Texrope drive, protecting the motor from shock, which the press might get from stray material finding its way into it. The agitator drive has been simplified; it is now driven by a roller chain running in an oil bath, entirely enclosed. Push-button controls within easy reach of the operators simplify their work and allows greater capacity. This company supplied the machinery for the 8-press plant of the National Brick Corp., Long Island City, N. Y., in 1929. Other equipment included four rod mills, volumeters and other equipment.

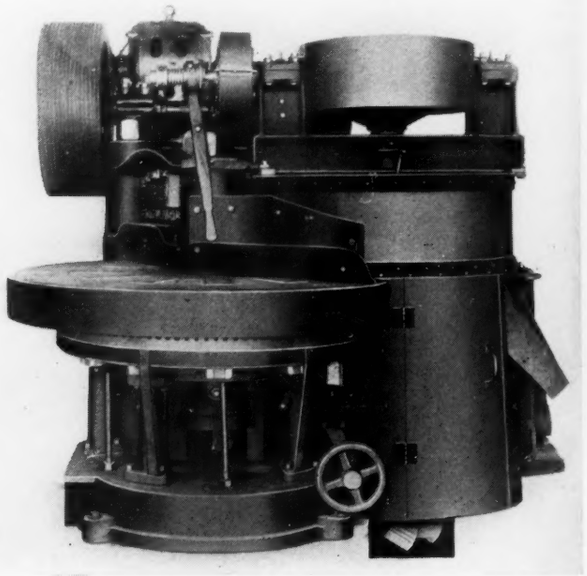


Fig. 127. Sand-lime brick press with short center drive

The W. A. Riddell Co. announces that it will soon place on the market a new rotary press for sand-lime brick.

Lubrication

THE big oil companies are beginning to take a real interest in the rock products industries and have done considerable research work to help them solve their lubrication problems scientifically. For example, the Standard Oil Co. of Indiana, through its technical division, prepared the results of some of this research in 1929 in a series, "Engineering Bulletins." Those of particular interest are: "The Storage and Handling of Lubricants," "Diesel Engines and Their Lubrication," "Lubrication of Compressors and Pneumatic Tools," "Maintaining the Quality of Lubricants in Service."

The Keystone Lubricating Co. perfected an automatic lubricating system controlled by a clock (Rock Products, November 9).

New York State Crushed Stone Association's Annual Meeting

THE ANNUAL meeting of the New York State Crushed Stone Association was held at the Hotel Syracuse, Syracuse, N. Y., December 20, 1929. Despite inclement weather there was a good attendance, and a very interesting meeting was held. Action was taken on a number of matters of considerable importance to the crushed stone producers of the state.

Otho M. Graves spoke interestingly of the way in which the Federal Commission on Trade Practices in cooperating with the national association and the industry to improve the ethical standards of doing business. He explained that officials of the commission will hold meetings at Cincinnati during the week of the National Crushed Stone Association convention in January, and it is expected that the association will formulate a code of ethcis covering the whole matter and that arrangements will be completed for the carrying out of this very worth-while cause, and obtaining the government's cooperation and help.

This is along the same lines as the government's cooperation with other industries to help them to solve some of their problems, and is not compulsory in any way, but entirely voluntary, amounting practically to self government within the industry.

Mr. Graves also spoke of the good work being done by the research department of the national association in Washington, D. C., and the importance to the whole industry of going on with it in even greater measure than at present.

New Lien Law Discussed

The committee which had been appointed to investigate and advise on the desirability of the proposed amendments to the New York state lien law, with A. G. Seitz as chairman, recommended that these amendments be endorsed. The association went on record as being in favor of Sections 21, 21-A and 25 of the proposed amendments, which have to do with the discharge of liens and the vacating of liens for public improvements, and the priority of liens and assignments under contracts for public improvements. These amendments are sponsored by the New York state branch of the Associated General Contractors of America.

The association also expressed itself in favor of an amendment to the effect that liens remain in force until cancelled instead of requiring renewal in six months as at present, and also as favoring the passage of a law requiring the bonding of contractors for materials; this, however, not to apply to the New York City metropolitan district.

In order to give credit information to members the association also favored the establishment of a credit bureau, in Syracuse preferably because of its central location, in connection with one of the existing bureaus. Further information is to be obtained on this and definite action taken at a later meeting.

Officers were chosen for the ensuing year. John H. Odenbach, Dolomite Co., Rochester, N. Y., was elected president; H. J. Russell, the Jointa Lime Co., Glens Falls, N. Y., vice-president, and A. S. Owens, Peerless Quarries Co., Utica, N. Y., re-elected secretary-treasurer.

It was decided to go to the Cincinnati convention in a body in two special trains, leaving Saturday afternoon, January 18.

Attendance (Producers)

Adams and Duford Co., Chaumont, N. Y., E. B. Johnson.
Buffalo Crushed Stone Co., Buffalo, N. Y., James Savage.
Cushing Stone Co., Schenectady, N. Y., J. E. Cushing.
Dolomite Products Co., Rochester, N. Y., Harvey Clark, John H. Odenbach, Walter Sickles.
General Crushed Stone Co., Syracuse, N. Y., Otho M. Graves, F. F. McLaughlin, F. C. Owens, George E. Schaefer, A. G. Seitz.
Jointa Lime Co., Glens Falls, N. Y., H. J. Russell.
L. and M. Stone Co., Prospect, N. Y., William McGrew.
Le Roy Lime and Stone Co., Le Roy, N. Y., Frank Howe.
Onondaga County Quarries, Syracuse, N. Y., James Pierce.
Peerless Quarries Co., Utica, N. Y., A. S. Owens.
Solvay Sales Corp., Syracuse, N. Y., J. H. Kaiser.
Wickwire Spencer Steel Co., Gasport, N. Y., W. E. Foote.

H. J. Russell

John H. Odenbach

Others

William Anderson, Hercules Powder Co., Buffalo, N. Y.; M. D. Caldwell, Atlas Powder Co., Rochester, N. Y.; W. J. Harrigan, E. I. Du Pont de Nemours and Co., Syracuse, N. Y.; Earl C. Harsh, Rock Products, Chicago, Ill.; B. H. Norton, E. I. Du Pont de Nemours and Co., Rochester, N. Y.

American Stone to Build $100,000 Crushing Plant at Lima

CONSTRUCTION of a $100,000 stone crushing plant will be started at once, according to the *Toledo* (Ohio) *Blade*. Purchase of 28 acres of quarry land has been made by the American Stone Corp. through W. R. France, president and manager. The site lies northeast of the city, between the old and new rights-of-way of the Detroit, Toledo & Ironton railroad. Most of the tract was owned by C. L. Bierley, Lafayette.

The plant will have a capacity of 200,000 tons per year.

Until recently the American Stone Corp. owned and operated quarries in Delphos. Toledo. See Rock Products, October 26, p. 95.)

H. W. Munday Joins Lime Equipment Firm

H. W. MUNDAY has become vice-president and sales engineer of McGann Manufacturing Co., Inc., York, Penn., designers and builders of lime and hydrate plants. Mr. Munday was formerly editor of *Pit and Quarry* and more recently general sales manager of Huron Industries, Inc. He will maintain offices at 228 North La Salle St., Chicago.

American Concern Awarded Contracts for Large Russian Cement Mill Program

MORE COMPLETE information has been received in regard to the details of the large contract which the Macdonald Engineering Co., Chicago, recently closed with the Soviet government of the U.S.S.R., by which the company has been appointed consulting, designing and supervising engineers in connection with the great program of cement mill construction included in the "Five-Year Industralization Plan" of the U.S.S.R.

Starting with an annual cement production of only 14,000,000 bbl. for 150,000,000 people, the "Five-Year Program" will bring this up to triple that figure. The Macdonald Engineering Co. will instruct in the design of the increase along American lines, taking charge of the engineering work for "Stromstroi," the Soviet cement department or "trust." The American engineers will be established in the offices of "Stromstroi."

The Macdonald company is also to instruct the construction department in the building of cement mills under American construction methods and with American construction machinery. Cement mills will be located at strategic points in the Russian soviet republics in Europe and Asia. Specifically, the first four mills will be as follows:

1,800,000 bbl. plant; wet process; high early strength; coal burning; limestone; including new power plant; to be built at New Spartak, Riazan province, 108 miles from Moscow on Riazen-Ural railroad.

1,800,000 bbl. plant; wet process; high early strength; coal or oil burning; limestone; separate power plant; to be built at Kashira, Moscow province, 60 miles from Moscow on Riazan-Ural railroad.

700,000 bbl. plant; wet process; high early strength; coal burning; limestone; including new power plant; to be erected at Black river, 30 miles south of Novosibirsk, Siberia, on the Altai railroad.

1,000,000 bbl. plant; dry process; coal and coke burning; blast furnace slag; separate power plant; to be built at Kertch, Crimea, on the Black Sea, and to ship both by water and by rail.

Other mills will follow as fast as plans are developed and construction gotten under way. The contract of the Macdonald Engineering Co. covers a period of years. A portion of the cement mill equipment will be purchased in America on recommendations of the Macdonald Engineering Co. by the Amtorg Trading Corp., New York, which is the purchasing department of the U.S.S.R. in the United States.

The Macdonald Engineering Co. have closed a similar contract with the U.S.S.R. for the design and construction of grain elevators and flour mills, another specialty of that company. A large force of engineers from both the cement and grain divisions is leaving for Moscow in January. Construction forces will follow in March.

The Russian operations of the Macdonald Engineering Co. will be in charge of J. C. Carter. The company also agrees that R. P. Durham, president of the Macdonald company, will visit Russia twice a year during the life of the contract. Mr. Carter's place as vice-president in charge of the eastern United States division of the Macdonald Engineering Co. will be assumed by P. N. Rylander, formerly chief engineer of that division.

Novel Advertising Scheme Aims at Better Distribution

SOMETHING decidedly new in trade journal advertising, aimed to help the individual distributor of its products, has been inaugurated by the Republic Rubber Co., Youngstown, Ohio. The company has contracted for space in 11 trade journals of 160,000 combined circulation in which 12 full page advertisements are to appear during the year. The copy is all institutional for the distributor and applies to any department of his business; in each insertion the distributor is quoted, thus advertising his own business.

In order to assist each distributor individually, the Republic company has arranged for making reprints of each advertisement so that the distributor may reach his mailing list each month with his own individual message. In all, about 40 firms are participating in the campaign.

Situation in Australian Cement Industry

(Trade Commissioner E. C. Squire, Sydney, in *Commerce Reports*)

THE PRESENT Australian consumption of cement amounts to approximately 68% of the productive capacity of domestic cement plants. Plant capacity totals 1,023,500 tons a year, more than half in New South Wales, and within the next few months it will be increased by about 165,000 tons. The directors of the Southern Portland Cement Co. have announced that their plant at Berrima, with an annual capacity of 100,000 tons, will come into production shortly, and recently the Goliath Portland Cement Co. of Tasmania contracted for new works designed to have a yearly output of 65,000 tons.

Inquiries in the trade indicate that consumption of cement in Australia reached about 700,000 tons in 1928, compared with 650,000 tons in 1927. The latest returns of the commonwealth statistician, for the fiscal year 1926-27, show a production of 638,175 tons, compared with 604,900 in 1925-26, or an increase of about 5½%. It is assumed that the production statistics for the two years are fairly satisfactory indications of consumption, since it is not probable that it would be the practice for long periods to manufacture in excess of sales.

Authorities in the trade state that it is difficult to determine whether 1928 was a normal year for consumption. It is believed in some centers that demand increased, in others that it fell off. Building was very active in Sydney, where sales were more than maintained. Decreases were registered in Victoria, South Australia and the country districts of New South Wales. Practically all works, except in western Australia, were closed in part for some period of the year because of lack of orders.

New South Wales accounts for about 60% of the total production of cement in Australia and has a market in practically all of the main consuming centers throughout the commonwealth. Its output advanced steadily from 187,800 tons in 1922 to 425,808 in 1927 and then dropped to 407,943 tons in 1928. An examination of the consumption figures for the whole of Australia shows that if the demand does not expand more rapidly than is indicated by the present volume of consumption it will be a considerable time before the market will be large enough to take all the cement turned out by all the plants working at capacity.

The export market cannot be expected to absorb very much of the output, even though total cement shipments in recent years increased gradually in value from £4277 in 1923-24 to £5044 in 1926-27. The principal hope of the industry lies in an increase in the domestic demand—for road construction, building and, particularly, for use on farms, which at present probably only accounts for about 5% of the total.

Arrested Import Decline Probable—Plans for Increasing Demand

With increased production, imports of cement into Australia have declined during recent years, but there is now a tendency for this decline to be stayed. It is reported that oversea competition again is beginning to be felt, especially in western Australia. During the past four years total imports fell from 527,723 hundredweight in 1924-25 to 376,675 in 1926-27, and then increased to 453,921 hundredweight in 1927-28. The fluctuation may be attributed partly to price.

Cement prospects for 1929 are considered good, but naturally the present industrial disturbances in Australia have a depressing effect on every industry. January business was fairly satisfactory except in South Australia. It is expected that demand will be influenced by the formation of the Australian Cement Manufacturers Association, which includes all the manufacturers of cement in the commonwealth. with two exceptions. This organization proposes to stress the advantages of building in concrete, to introduce new uses for cement and to adopt other measures in the effort to expand domestic consumption.

Traffic and Transportation

Car Loadings of Sand and Gravel, Stone and Limestone Flux

THE following are the weekly car loadings of sand and gravel, crushed stone and limestone flux (by railroad districts) as reported by the Car Service Division, American Railway Association, Washington, D. C.:

CAR LOADINGS OF SAND, GRAVEL, STONE AND LIMESTONE FLUX

District	Limestone Flux Week ended Dec. 7	Sand, Stone and Gravel Week ended Dec. 7
Eastern	1,936	3,026
Allegheny	2,335	3,055
Pocahontas	230	556
Southern	591	5,621
Northwestern	570	1,209
Central Western	380	7,020
Southwestern	486	5,223
Total	6,528	25,710

COMPARATIVE TOTAL LOADINGS, BY DISTRICTS, 1928 AND 1929

District	Limestone Flux 1928 Period to date Dec. 8	Limestone Flux 1929 Period to date Dec. 7	Sand, Stone and Gravel 1928 Period to date Dec. 8	Sand, Stone and Gravel 1929 Period to date Dec. 7
Eastern	144,455	160,292	545,914	545,557
Allegheny	168,133	172,320	366,186	356,990
Pocahontas	22,324	18,306	40,285	48,838
Southern	28,645	29,651	519,169	425,010
Northwestern	63,252	53,701	318,483	301,106
Central Western	21,837	25,578	494,636	514,147
Southwestern	19,966	24,612	311,648	336,044
Total	468,612	484,460	2,596,321	2,527,692

COMPARATIVE TOTAL LOADINGS, 1928 AND 1929

	1928	1929
Limestone flux	*468,612*	*484,460*
Sand, stone, gravel	*2,596,321*	*2,527,692*

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week beginning December 28:

TRUNK LINE ASSOCIATION DOCKET

22495. **Limestone, unburnt, ground or pulverized** carloads, minimum weight 50,000 lb., from Martinsburg, W. Va., and Group 1, as per B. & O. R. R. I. C. C. 21047, to Grove, Frederick, Lime Kiln, Keller and Buckeystown, Md., 5c per 100 lb. (Present rate, 6c per 100 lb.) Reason—Proposed rate is comparable with rates from Stephens City, Va.

22512. **Crude dolomite,** carloads (See Note 2), from Millville and Martinsburg, W. Va., to Lorain and Cleveland, O., $2.20 per gross ton. (Present rate, 18½c per 100 lb.) Reason—Proposed rate is comparable with rate on roasted dolomite from and to same points.

22525. **Sand, blast, building, engine, foundry, glass, quartz, silex or silica,** carloads (See Note 2), from Pinewald, Toms River and Quail Run, N. J., to Kitchener, Ont., 24½c per 100 lb. (Present rate, 38c per 100 lb, sixth class.) Reason—Proposed rate is comparable with rates on like commodities for like distances, services and conditions.

22526. **Sand,** carloads (See Note 2), from Toms River, N. J., to Hull, Que., 26½c per 100 lb. (Present rate, 39½c per 100 lb., sixth class.) Reason—Proposed rate is comparable with rates from Bridgeton, Vineland and other South Jersey shipping points.

22527. **Sand,** carloads (See Note 2), to Dalhousie, N. B., from Tullytown, Philadelphia stations, Honey Brook and Narvon, Penn., Trenton stations, Riverside, Arch St., Palmyra, Masonville, Hainesport, Mt. Holly and Birmingham, N. J., present 39c, proposed 55c; Vineland to Cape May N. J., present 41c, proposed 60-67c. Above rates in cents per 100 lb. Reason—Proposed rates are comparable with rates now in effect to Campbellton, N. B.

22533. **Sand,** other than blast, engine, foundry, molding, glass, silica, quartz or silex, **also gravel,** carloads (See Note 2), from Wilmington, Del., to Lambson and Worton, Md., $1.05 per net ton. Present rate, $1.15 per net ton. Reason—Proposed rate is comparable with rate from Bacon Hill, Northeast, Charleston and Principio, Md.

22539. **Sand and gravel,** carloads (See Note 2), from Farmingdale and South Lakewood, N. J., to Bridgeton, N. J., $1.15 per net ton. Present rate, $1.27 per net ton. Reason—Proposed rate is comparable with rates from Farmingdale and South Lakewood, N. J., to Atlantic City, N. J., and from Pinewald, N. J., to Philadelphia, Penn., and North Branch, N. J.

22560. **Ground limestone,** carloads, minimum weight 50,000 lb., from Bellefonte, Penn., and Pleasant Gap, Penn.

To	Prop.
Harlem River to Woodlawn, N. Y.	21½
Larchmont Manor, N. Y., to Wickford Jct., R. I.	24½
Davisville, R. I., to Danbury, Conn.	24½
Bellefonte to Buttonwoods, R. I.	24½
Goulds to Narragansett Pier, R. I.	26½
Saylesville, R. I.	24½
South Manchester, Conn.	24½
Hopedale to North Grafton, Mass.	25

Rates in cents per 100 lb.

Reason—Proposed rates are comparable with rates from York, Penn.

Note 1—Minimum weight marked capacity of car.

Note 2—Minimum weight 90% of marked capacity of car.

Note 3—Minimum weight 90% of marked capacity of car, except that when car is loaded to visible capacity the actual weight will apply.

CENTRAL FREIGHT ASSOCIATION DOCKET

Sup. No. 1 to W. D. A. 23381—Withdrawal notice—White Docket Advice No. 23381, Docket Bulletin No. 1691 of November 26, 1929, covering proposal to establish on **sand and gravel,** carloads, from Lafayette, Ind., to Belshaw and North Haven, Ind., rate of 85c and to Cooke, Ind., rate of 90c per net ton is hereby withdrawn from the docket.

23479. To establish rate of 65c per gross ton (2240 lb.) from Carey and McVittys, O., to Toledo, O., on **raw or crude dolomite,** carloads (See Note 3), subject to the following provisions:

1—Rate to apply only to Toledo, O., and only on raw or crude dolomite for transshipment via lake, and is subject to additional charges for the service of transferring the raw or crude dolomite from cars to vessels at dock.

2—Raw or crude dolomite arriving at Toledo, O., for transshipment via lake will be subject to car service charges while awaiting discharge into vessels, lawfully in effect and on file with the Interstate Commerce Commission as to interstate traffic and with the public utilities commission of Ohio as to state traffic. Present—Present rate of $1.01 per gross ton (2240 lb.), published in C. C. C. & St.L. Ry. Tariff 1732K.

23487. To establish on **sand** (other than blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding **or silica) or gravel,** carloads, from Harbor Bridge, Penn., to Kaylor, Penn., rate of $1 per net ton. Present rate, sixth class rate of 13½c.

23488. To establish on **crushed stone,** carloads, from Spore, O., to points in West Virginia, rates as shown:

To	Distance	Prop.	Pres.
Parkersburg, W. Va.	188	170	Class
Milwood, W. Va.	223	180	Class
Ravenswood, W. Va.	222	180	Class

23489. To establish on **stone, crushed,** in bulk, in open-top cars, carloads, from Gibsonburg and Woodville, O., rate of $1.45 per net ton to Byesville, Pleasant City and Caldwell, O., and $1.65 per net ton to Marietta, O. Present rates, classification basis.

23490. To establish on **sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding and silica) **and gravel,** carloads, from Shore Acres, N. Y., to Brockton and Portland, N. Y., rate of 70c per net ton. Present rate, classification basis.

23503. To establish on **molding sand,** carloads, from Pontoosuc and Dallas City, Ill., to Meadville, Penn., rate of $5.10 per ton. Present rate, $6.90 per ton (sixth class).

23505 (Cancels W. D. A. No. 23425). To establish on **stone, crushed, rough, rubble, rip rap, quarry, scrap screenings,** carloads (See Note 3), from Whitehouse, O., to Paulding, O., rate of 90c per net ton. Route—Wabash, Cecil, O., C. N. Present rate, 100c.

23514. To establish on **sand, blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica,** in straight carloads, from Rush Run, O., to West Homestead, Penn., rate of $1.39 per net ton. Route—Via Homestead Transfer, Penn., and P. & L. E. R. R. Present rate—No through class or commodity rates in effect.

23515. To establish on **gravel and sand,** carloads, from Brilliant and Rush Run, O., to Canton and Massillon, O., rate of 100c per net ton. Route—Via P. R. R. direct. Present rate, 110c per net ton.

23523. To establish on **sand and gravel,** carloads, from Howard, O., rate of 110c to Sandusky and 125c per net ton to Toledo, O. Present rates, 120c to Sandusky and 140c per net ton to Toledo, O., per Penn. R. R. Tariff Ohio F1445.

23537. To establish on **sand and gravel,** carloads, from Columbus, O., to points in Ohio, rates as shown below:

To	Prop.	Pres.	To	Prop.	Pres.
Sonora	95	100	Cochran Mine	115	120
Bridgeville	95	100	Barnesville	115	120
Norwich	95	100	Tacoma	115	120
New Concord	100	110	Speidel	115	120
Cassell	100	110	Bethesda	115	120
Cambridge	100	110	Belmont	115	120
Mineral Siding	100	110	Lamira	115	120
Kipling	105	110	Warnock	115	120
Kings Mine	105	110	Glencoe	125	140
Lore City	105	110	Maher Mine	125	140
Gibson	105	110	Stewartsville	125	140
Salesville	105	120	Neffs	125	140
Quaker City	105	120	Bellaire	125	140
Eldon	105	120			

23550. To establish on **sand and gravel,** carloads, from Chillicothe, O., to Wellston, O., rate of 60c per net ton. Present rate, 11½c.

23554. To establish on **crushed stone,** carloads (See Note 1), except when car is loaded to full cubical or visible capacity actual weight will apply, from Mitchell, Ind., to Jeffersonville, Ind., rate of $1.05 per net ton. Present rate, 13½c.

NEW ENGLAND FREIGHT ASSOCIATION DOCKET

18687. **Common building sand** (See Note 3), from Scotia, N. Y., to Waterford and West Waterford, N. Y. Present rate, 12½c ($2.50 per net ton); proposed, $1.05 per net ton. Reason—To grant shippers a commodity rate to Waterford and West Waterford, N. Y., comparable with those now in effect to other points in New York state.

SOUTHERN FREIGHT ASSOCIATION DOCKET

48486. **Sand, gravel, crushed stone, etc.** from Big Stone Gap and Glenita, Va., to N. & W. Ry. stations in Virginia, also Norton, Va. Lowest combination now applies. It is proposed to establish commodity rates on sand, gravel, crushed stone, slag, rubble stone, broken stone and chert, straight or mixed carloads (See Note 3), from Big Stone Gap and Glenita, Va., to N. & W. Ry. stations in Virginia on the Pocahontas and Radford divisions, also to Norton, Va., on basis of I. C. C. Docket 17517 scales. Statement of proposed rates to the destinations involved will be furnished upon request.

48491. **Sand, gravel, etc.,** from Red Bay, Ala., to Nashville, Tenn. Combination rates now apply. Proposed rate on sand, gravel, etc., as described in Agent Glenn's I. C. C. A-655, from Red Bay, Ala., to Nashville, Tenn., 160c per net ton. Made on basis of I. C. C. Docket 17517 joint scale.

WESTERN TRUNK LINE DOCKET

7115. **Stone, crushed,** carloads (See Note 3), but not less than 40,000 lb., from Swank, Ia., to points in Missouri). Present rates, Class "E."

To (representative Missouri pts.)	Pres.	Prop.
Laclede	15½	7
Carrollton	17	8
Chillicothe	15½	7½
Cameron	17	8½
Medill	11	4½
Downing	12	5½
West Quincy	11	5
Hurdland	12	6½
Trenton	15½	7
Pattonsburg	17	8

(Copy of complete exhibit will be furnished upon request.)

6983. **Sand, silica,** from Muscatine, Ia., and Browntown, Wis., to destinations in C. F. A. territory, as named in Agent Boyd's Tariff 41-P.

FROM MUSCATINE, IA.

To	Present Processed	Present Crude	Proposed Processed	Proposed Crude
South Bend, Ind.	*2.90	2.27	2.40	2.00
Indianapolis, Ind.	2.77	2.39	2.64	2.20
Toledo, O.	3.28	.....	3.00	2.50
Ft. Wayne, Ind.	3.03	2.77	2.64	2.20
Detroit, Mich.	3.28	.....	3.24	2.70
Grand Rapids, Mich.	3.28	3.03	2.88	2.40

FROM BROWNTOWN, WIS.

To	Proposed Processed	Proposed Crude
South Bend, Ind.	2.10	1.80
Indianapolis, Ind.	2.52	2.10
Toledo, O.	2.76	2.30
Ft. Wayne, Ind.	2.40	2.00
Detroit, Mich.	2.76	2.30
Grand Rapids, Mich.	2.16	1.80

Present—Through class rates.
*Silica sand only.

I. C. C. Decisions

IN I. and S. No. 3313, agricultural limestone from Gibsonburg, O., and Michigan points to destinations in Michigan, the Commission, by division 3, has found not justified proposed rates on agricultural limestone, in box cars, carloads, from Gibsonburg and Woodville, O., and Monroe and Sibley, Mich., to destinations in Michigan, over interstate routes. The schedules have been ordered canceled without prejudice to the filing of new schedules in conformity with the views expressed in the report. The Commission said the record indicated that interstate rates from Monroe and Sibley on the basis prescribed from Gibsonburg in National Mortar & Supply Co. vs. Ann A. R. Co., 152 I. C. C. 429, would be justified and nothing in present record warranted modification of the conclusions in the National Mortar case. It was its opinion that in computing distances under the scale prescribed in the National Mortar case the shortest routes by existing connections for interchange of carload traffic should be used, and that carriers considered as one line for the purpose of computing rates from the Michigan producing points should likewise be considered as one line for the purpose of computing the rates from Gibsonburg. Respondents are expected promptly to comply with the Commission's order in the National Mortar case, according to the report. The suspended schedules were filed by respondents in purported compliance with the order in that case, said the Commission.

Milwaukee Sand Rates Found Reasonable

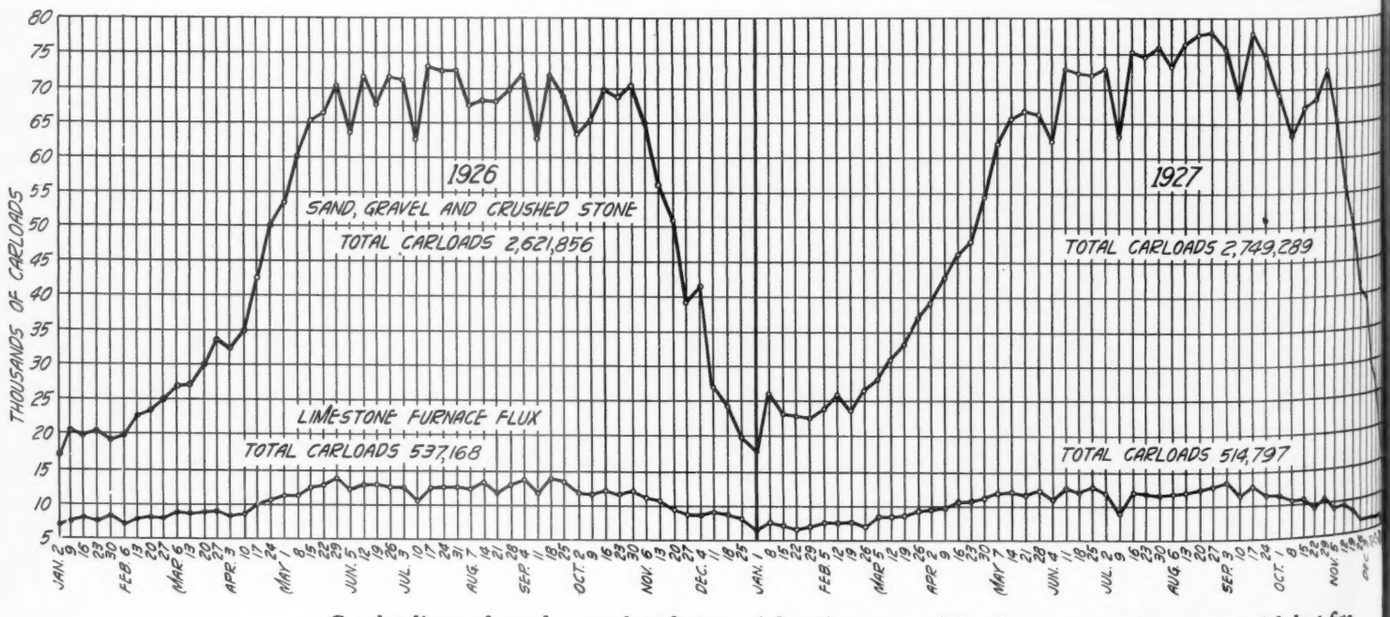
A PETITION for a reduction from 4.4 cents per 100 lb. to 4 cents on sand used in Beloit foundries shipped from Milwaukee has been denied by the state railroad commission. It was alleged that the rate was unjust, and the complaint asked reparation on past shipments and a reasonable rate for the future. The sand comes from Pigeon Hill, Mich., at a total cost of $1.62 per ton, the commission found, as compared to $1.39 per ton from Michigan City, Ind. The sand is of peculiar quality and does not compete with the Wisconsin product.

Aggregate Producers to Present United Case at Hoch-Smith Rate Hearing

AT A recent meeting in Kansas City, Mo., attended by 40 producers of sand, gravel and crushed stone in Arkansas, Oklahoma, Missouri and Kansas, it was decided to present a united case before the I. C. C. investigation designated as No. 17000, Part 11A, set for a hearing on February 3, 1930. The Commission at that time is to investigate and pass on the rates for crushed stone, sand and gravel and similar commodities moving interstate and intrastate in the above states.

A steering committee was named to have charge of the case and they selected E. H. Hogueland, commerce counsel, Kansas City, Missouri, to represent the industry. It was determined that between $4,000 and $5,000 would be necessary to properly prepare the case and a subscription was started to secure this amount. Substantially more than half of the necessary amount has been subscribed. These subscriptions ranging from $75 for small producers having an output up to 25,000 tons a year, and ranging up to $400 for producers having an output of 500,000 to 750,000 tons per year.

The steering committee comprises John Prince, Stewart Sand & Material Co., Kansas City, Mo., chairman; W. E. Rogers, Arkansas River Sand Co., Tulsa, Okla.; J. M. Chandler, Hughes Stone Co., Tulsa, Okla.; Otto Kuehne, Kansas Sand Co., Topeka, Kan.; Fred Gades, Consumers Sand Company, Topeka, Kan.; Wm. Bugg, Consumers Material Corp., Kansas City, Mo.; Mr. Eschenberg, St. Louis Material & Supply Co., St. Louis, Mo.; F. W. Peck, Peck-Thompson Sand



Car loadings of sand, gravel and stone (above) compared for four consecutive years; with last five

Co.; W. W. Dills, Yahola Sand & Gravel Co., Muskogee, Okla.

The following points were agreed upon at the producers' conference:

(a) Co-operation was highly desirable.

(b) Commodity descriptions set out in I. C. C. No. 17,000, Part II, satisfactory.

(c) Same rate level in entire territory involved in I. C. C. No. 17,000, Part 11-A, would be satisfactory to all, but right reserved to fight for lower basis in case competing rates make such action necessary.

(d) Single and joint line scales, with joint line differentials not in excess of those prescribed in I. C. C. 17,000, Part 11, favored. Short haul rates should be reduced, while long haul rates might be increased. Distances to be figured according to Commission's present formula.

(e) Combination rule, where now effective, should be maintained or its equivalent provided for.

(f) Maintenance of group adjustments and special rates considered of local concern.

Canada Cement Had a Good Year in 1929

A. C. TAGGE, president of the Canada Cement Co., Ltd., in his report to shareholders for the year ended November 30, discussing the company's progress during this period, said:

"Your company has shared in the continued activity in the building trades and sales of cement have been larger in practically all districts. This has enabled us to operate our plants more continuously and has resulted in some operating economies. The improvement in this respect has been greatest in the West and has enabled us to make a reduction in price throughout that district, this being in accord with our established policy of encouraging the use of our product by reducing the price whenever circumstances permit. Prices in other districts have remained at practically the same level as last year.

"Our export business is still handicapped by the lower labor costs and the lower ocean freight rates of European competitors, and remains about the same as for several years past. The reconstruction of our Hull, Que., plant was completed and the plant put into operation in June of this year. It is showing very satisfactory results.

"In order to provide better service and more economical distribution of our product along the Eastern seaboard, storage and shipping plants are being established at several important points. For this purpose suitable properties have been acquired at St. John, Halifax and Quebec. The storage bins and packing plants have been completed at Halifax and Quebec and similar equipment will be built at St. John during the coming year. In order to supply these distributing points with cement and bring back from Nova Scotia the gypsum used at our Eastern plants, we have had constructed a self-discharging vessel of 3500 tons carrying capacity specially designed for handling and unloading these materials in bulk."

Electric Supply System Organized

NINETEEN wholesale electrical supply companies doing a total annual business of $60,000,000, with branches in sixty cities, have been organized by the Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa., into a single system under the name of the Westinghouse Electric Supply Co., with headquarters at 150 Broadway, New York City.

Previous to the reorganization, these companies were owned by the Westinghouse Commercial Investment Co., a subsidiary of the Westinghouse Electric and Manufacturing Co., but conducted business under their own names and with their own corporate organizations.

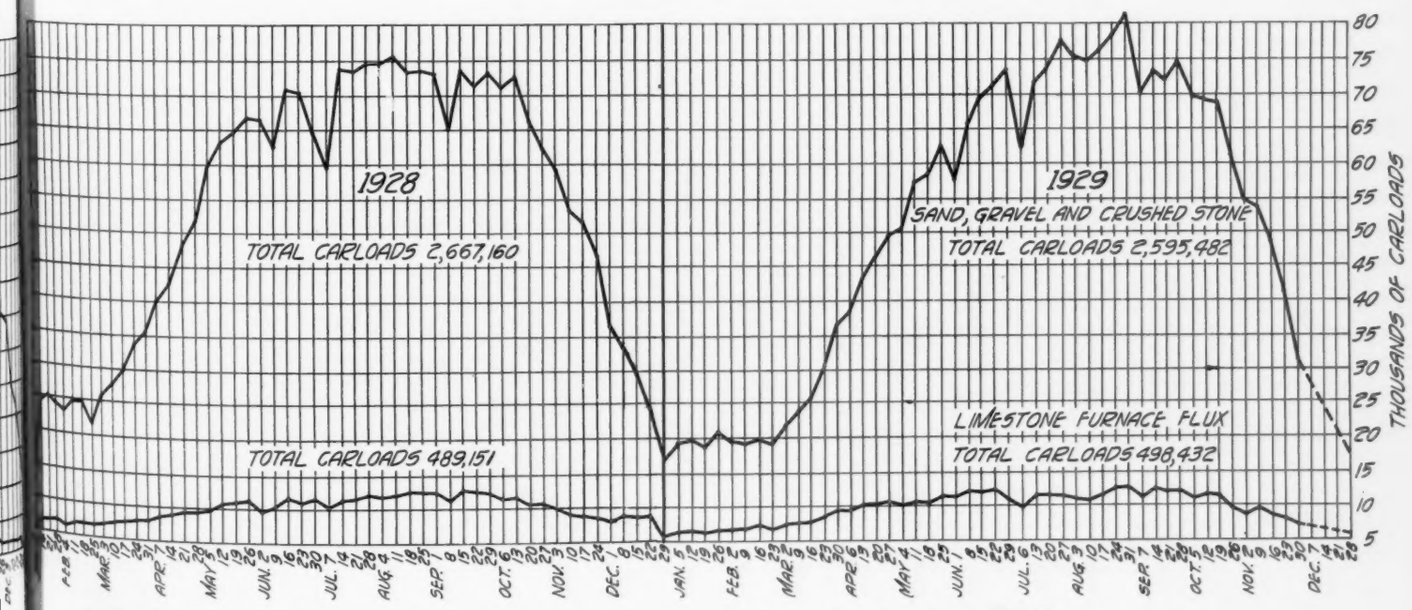
South Dakota Cement Plant to Pay $150,000 to State

SOUTH DAKOTA state cement plant, Rapid City, S. D., is ready to turn back another $150,000 into the cement plant interest and sinking fund in the state treasury, George Philip, commission chairman, announced recently. This will make a quarter of a million dollars turned back this year, he said.

The original $275,000 borrowed from the general fund for an operating fund for the plant was turned back before repayments began. In addition to this, a total of $450,000 has been turned over to the state treasury up to this time, and the $150,000 to go back before the first of the year will bring the total so turned over to $600,000, the chairman pointed out.—*Sioux Falls* (S. D.) *Argus-Leader.*

Sand, Gravel, Stone and Limestone Flux Car Loadings in 1929

ACCORDING to statistics furnished by the American Railway Association, total car loadings of sand, gravel and crushed stone in 1929 were about 2,595,482 carloads as compared with 2,667,160 in 1928. There was a slight increase in limestone flux loadings, 498,432 cars being shipped against 498,151 for 1928. The graphs below give the car loadings of the materials for four consecutive years, 1925 to 1929, inclusive, from which our interesting comparison can be made.



weeks of 1929 figures interpolated. Below, the same data on limestone flux for the steel industry

Valuation of California Limestones*

By James M. Hill

Geologist, Berkeley, Calif.

THE valuation of limestone deposits in California is so entirely different from the problem in the eastern states that without a real knowledge of the relative scarcity of limestones in California the problems involved cannot be understood. Location with respect to markets and transportation is probably the second most important factor in California. To add to the difficulties of valuation of the state's limestone deposits are their extreme irregularity of size, position with respect to mining and chemical composition. Most of the deposits in California that are near markets are irregular lenticular bodies, which may vary from dolomite to limestone in relatively short distances, and which present many problems in mining.

Freight rates play an important part in the workability, or rather marketability, of limestone. From a close study of the situation it is clearly evident that, unless under exceptional conditions, limestone or limestone products cannot be transported more than 100 miles to consuming centers. It is also true that by far the greatest part of limestone products are shipped less than 50 miles to consumers.

Limestone for the cement industry is generally not transported more than a few miles as limestone, though in California there have been two notable exceptions to this procedure. The Pacific Portland Cement Co. used crude limestone from a quarry near Auburn, Placer county, for its plant at Cement, near Suisun, Solano county, shipping a distance of approximately 85 miles at a freight rate of 80 cents per ton. Yosemite Cement Co., whose plant is at Merced, uses limestone mined near El Portal, Mariposa county. The haul on crude rock is 63 miles and the freight rate approximately 1 cent a ton-mile.

Builder's lime finds its chief market in the large centers of population, and San Francisco bay area, Sacramento, Stockton, Merced, Fresno and Bakersfield, in the Great Valley, and the Los Angeles and San Diego areas, in the southern part of the state, are the large markets. The chief producing centers are the same as for agricultural lime, though the product sold to the building trades is burned lime and not ground limestone.

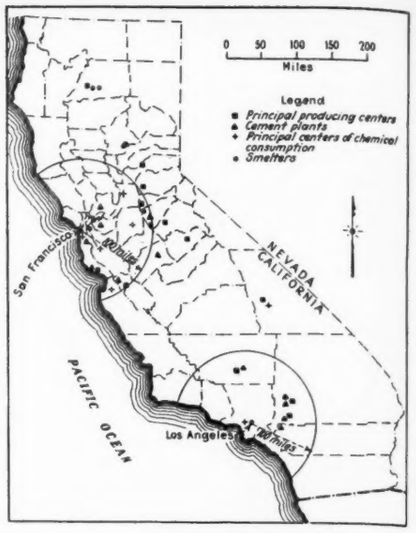
Agricultural lime is used throughout the state, and frequently local limestone deposits are sources of supply, though the bulk of agricultural lime has come from the main producing centers. The radius of shipment from these centers has been limited in part by mining and grinding costs at each individual plant, but probably more by railroad rates. The principal producing points for agricultural lime are Kennett, Shasta county; Auburn, Placer county; Shingle Springs, Eldorado county; Ione, Amador county; Sonora, Tuolumne county; Felton and Santa Cruz, Santa Cruz county; Hollister and San Juan, San Benito county; Monterey and Salinas, Monterey county; Tehachipi, Kern county, and Colton, Oro Grande, and Victorville, San Bernardino county.

Limestone for the chemical industries, including the sugar refineries, is shipped crude in car lots. Generally, the sugar refineries are supplied from local deposits. The large chemical industries of the San Francisco bay area obtain limestone from the deposits in Placer, Santa Cruz and San Benito counties. The Los Angeles industry is largely supplied by the limestone producers at Colton and Victorville, though some limestone and dolomite is shipped to Los Angeles from Tehachipi and from the deposits on the west side of Inyo county.

Distribution of Deposits

Larger deposits of limestone are situated in the desert counties of southern California than in any other part of the state, but owing to their distance from markets and the lack of cheap rail transportation, most of them have little or no commercial value. Deposits close to railroads and large consuming centers, as at Tehachipi, Kern county, and Oro Grande, Victorville, and Colton, in San Bernardino county, have been developed extensively and supply most of the requirements of California south of Tehachipi.

In the northern part of the state are a series of large and small lenticular bodies of limestone in the foothills of the Sierra, which have been utilized at various places, but have been extensively exploited only near rail transportation and within close proximity to markets, as at Sonora, Tuolumne county; Ione, Amador county; Shingle Springs, Eldorao county, and Auburn, Placer county. In the coast ranges there are also bodies of limestone, none of which, except those in Santa Clara and San Benito counties, have been worked to any great extent, owing to their distance from markets and the lack of transportation. In the northern counties are relatively large bodies of limestone which cannot possibly be considered of economic interest. The deposits near Pitt river, in Shasta county, are the only ones in the north end of the state which appear to have any promise of future use.



Sketch map of California showing principal producing and consuming centers of limestone

In Calaveras and Tuolumne counties, which has been worked extensively for lime and marble near Columbia and Sonora, is every gradation between dolomite and marble, all within a short distance. As a consequence mining of limestone in this area is carried on with close chemical supervision.

At several places in Contra Costa, Solano, and Napa counties travertine bodies have been deposited by springs near irruptive rocks. These have not proved satisfactory sources of limestone for cement plants situated near Napa Junction and Suisun. Oyster and clam shell marls at the south end of San Francisco bay have been dredged for shell, which is adaptable for agricultural use and cement manufacture.

In the San Diego Mountains are some small bodies of limestone; these have had little or no exploitation, except for local use. Along the coast in San Luis Obispo, Santa Barbara, Los Angeles and Orange counties, large accumulations of oyster and clam shell on raised beaches or terraces are found at a few places. These have been a source of lime for local use at Capistrano, San Fernando and Santa Margarita.

*Abstracted from *Engineering and Mining Journal.*

Concrete Block Pamphlet

THE Portland Cement Association, Chicago, announces the publication of a new pamphlet, "Concrete Masonry," subtitle, "Concrete Building Units." This booklet is intended to serve as a sales promotion aid for manufacturers of concrete block who use sand and gravel or crushed stone aggregates. It is the third of a series of five publications on approved types of concrete building units, the first one dealing with cinder concrete and the second stone tile. Others will be issued on burned shale (Haydite) building units and on concrete building tile.

News of All the Industry

Incorporations

The Gypsum Co., Wilmington, Del., $1,000,000.

Hudson River Sand and Gravel Corp., 307 Fifth Ave., New York City, 250 shares common. E. Herrmann.

Transit Mixed Concrete Corp., Allentown, Penn., $50,000. Treasurer, Walter C. Laros, Easton, Penn.

T. E. Stephenson Sand and Gravel Co., Jackson, Miss., $30,000.

General Gypsum Co. changed name to Building Products, Inc., Boston, Mass.

Washington Pacific Lime Co., Seattle, Wash., $150,000. R. F. Mather, Stuart Mannell and S. M. Brackett.

C. E. Tobinson Sand Co., Seco, Ky., $3,000. Randall A. Leach, C. E. Tobinson and Cynthia Adkins.

Peoples Concrete Block Co., Inc., Hammond, Ind., 150 shares par value $100 each. Alexander J. Marko, Robert H. Harrington and Steve J. Marko.

France Lime and Stone, Inc., Toledo, Ohio, 20,000 shares no par common stock. To consolidate two properties of the France Stone Co. at Logansport, Ind.

Calcium Carbonate Corp., Wilmington, Del., 50,000 shares, no par value. To deal in limestone and limestone products. H. E. Grantland, H. H. Snow, and L. H. Herman, Wilmington, Del.

The Cast Stone Co., Columbus, Ohio, $60,000. Harry G. Price, Chas. L. Mahon, Irene J. Foit, Riley H. Bean and Williard H. Peterson. Agent: Harvey G. Price, 61 W. Third Ave., Columbus.

Gatesville Gravel Co., Gatesville, Miss., $15,000, comprising 150 shares par value $100 per share. C. E. Fairley, Hattiesburg, Miss., and George H. Smith, Crystal Springs, Miss.

Acme Marble Co., Chicago, Ill., $12,500. Fred F. Packman, Joseph L. Archer and Lillian Drews. Correspondent: Claude J. Dalenberg, 77 W. Washington St., Chicago.

Olean Gravel Corp., Olean, N. Y., 1,000 shares common stock, no par value. Harry D. Shay and Harry R. Moran of Olean, and Mrs. Frances F. Hatch, Wellsville, N. Y.

Concrete Products, Inc., Lynn, Mass., $50,000. To manufacture and deal in sand, stone, cement, concrete and concrete products. B. Fortuna of Lynn, Ernest Carrera and Remo J. Radica, both of Boston.

Holston Quarry Co., Knox County, Tenn., and Holston Quarry Co. of South Carolina, Knoxville, Tenn., both reincorporated, $500,000 each. Thomas McCroskey, R. S. Campbell, W. H. McCroskey, G. V. Keister and Charles M. Seymour.

Building Material Co., Inc., Hartford, Conn., $1,000,000, consisting of 10,000 shares preferred of $100 par value, and 40,000 shares common, no par value. Grant U. Kierstead and Howard M. Guernsey of West Haven, Conn., and Alexander W. Creedon, Hartford.

Quarries

Crab Orchard Stone Co., which operates a quarry four miles east of Crossville, Tenn., is extending its activities. More than 30 men are now at work here stripping and preparing two acres of ground to extend the quarry face.

Cooper Crushed Stone Co.'s plant on Harvey's Creek road, north of West Nanticoke, Penn., was damaged by fire on December 17 to the extent of approximately $12,000. The cause of the fire, which damaged conveyors, crushers and other equipment and destroyed several large dump trucks, has not been determined.

The Crown Rock Asphalt Co., Cincinnati, Ohio, has been reorganized and absorbed by the Crown Rock Co., incorporated at Columbus, Ohio. The plant is located in Grayson County, Ky., and offices will remain at Cincinnati. Charlton Wilder is president, Wm. Proctor, vice-president, and Robert L. Black, secretary.

Winder, Ga. Extensive granite deposits have recently been discovered on a 40-acre tract of land north of Winder owned by J. R. Austin, who contemplates organizing a company and opening a quarry here in the near future. The stone has been examined and found suitable for road work, building purposes and for monumental stone.

Georgia-Quincy Granite Co., Macon, Ga., are reported to have sold their Granite Hill, Ga., quarries, operated by the company for 40 years, to large South Carolina granite interests. The report states that the new owners will take possession on January 1, and operate them on a larger scale than they have ever been operated before.

Atlas Rock Co., Miami, Fla., recently purchased two additional 150-hp. Diesel engines for its Red road quarry, one of which will be installed in the crusher plant proper and the other on board a dipper dredge which will be operated for the purpose of getting down to the harder rock in the bottom of the excavated area.

France Lime and Stone, Inc., Toledo, Ohio, incorporation notice of which appears in this issue, has been formed for the purpose of consolidating the two properties of the France Stone Co. at Logansport, Ind. The company has had one plant west of Logansport for about four years, and is now erecting a new stone crushing and lime plant on property which it recently acquired four miles east of Logansport.

Sappington, Mont. The Great Western Sugar Co. of Billings has acquired large limestone deposits here which when quarried will be used to make milk of lime, a factor in the treatment of beet juices in sugar manufacture. A special power line from Willow Creek, Mont., to Sappington, to furnish current for two big motors to drive compressors at the quarry, has been constructed. The company will require not less than 20,000 tons of lime rock annually, it is estimated.

Sand and Gravel

Fountain Sand and Gravel Co., Pueblo, Colo., is erecting a new office building on its property at 410 East Eighth St., Pueblo, and products of the company are being used in its construction. In addition to the main and private offices which the new addition will house, provision has been made for a spacious storeroom. Fred H. Bullen is president of the company and J. A. Bullen is manager.

Cement

Missouri Portland Cement Co., St. Louis, Mo., held a three-day business conference recently at the Elms hotel in St. Louis. Sixteen executives of the cement organization, including H. L. Block, Daniel C. Taylor, W. C. Moorehead and other officials from St. Louis were present together with men representing the different offices and plants of the company. L. W. Baldwin of St. Louis, president of the Missouri Pacific railroad, was a guest.

Lime

Washington Building Lime Co., Baltimore, Md., which operates plants at Bakerton, W. Va., Strasburg, Va., and Woodville, Ohio, has opened an office in Toledo, Ohio, at 609 Home Bank Bldg., under the management of G. H. Faist, who was associated with the Woodville Lime Products Co. for a good many years.

Cement Products

J. B. Newsom, Bloomington, Ind., has invented a process for making building brick out of waste stone. More than 100,000 bricks have been manufactured by the new process during the last two months at the Johnson mill and quarry south of Bloomington. The first house built of the new material has just been completed in the vicinity and is said to be striking in appearance.

Spokane Concrete Pipe Co., Spokane, Wash., which manufactures concrete sewer pipe, concrete blocks and other concrete products, has torn down its frame building at N2627 Dakota St., and will replace it with a concrete block plant 100x100 ft., to be constructed of the company's own product. Cost of the improvement is estimated at $5,000. Carl B. Warren is president and A. W. Morris, secretary-treasurer.

Agricultural Limestone

Hope, Ark. The first full trainload of agricultural limestone ever delivered in one consignment to any one county in Arkansas was received here early in December and a day of celebration was put on by the farmers, agricultural agents and citizens of the county, topped off with a banquet. A train of 15 cars of limestone arrived over the Missouri Pacific railroad and the farmers started unloading for their farms. The event was attended by John T. Stinson, director of agricultural development of the Missouri Pacific, and other representatives of the agricultural department.

Wisconsin. Farmers of this state are constantly using more and more agricultural limestone as fertilizer. During the past year an increase of 7.6% was shown in the amount of limestone spread on Badger fields, according to Griffith Richards, soils specialist at the Wisconsin College of Agriculture. During the winter of 1928-29 there were 151,743 tons of agricultural limestone used in 32 of Wisconsin's 71 counties. Of the 151,743 tons of agricultural limestone, 21,496 tons were shipped in and 73,285 tons locally crushed. Mr. Richards is conducting 19 soil fertility schools in as many Wisconsin counties this winter to discuss the characteristics of soil building materials and their appropriate usage.

Miscellaneous Rock Products

Consolidated Feldspar Co.'s new feldspar grinding mill at Keystone, S. D., is operating at full capacity of 3000 tons of finished product per month.

Birmingham, Ala. Directors of the Swann Corp., the holding company for Federal Phosphorus Co., Brown-Marx Bldg., Birmingham, have voted to increase capital issue for expansion in activities of subsidiaries.

Smith Bros., Los Angeles, Calif., has purchased seven acres of land adjacent to the Union Pacific tracks at Hynes, Calif., and work has already begun on the foundation of a new quartzite factory which it is reported will be in operation by January 1.

Rathbun Co., Inc., has completed a plant at El Paso, Tex., for the manufacture of sodium silicate. The plant has a total monthly capacity of approximately 300,000 lb. and is equipped to manufacture the product in various grades for use in the soap, mining, textile and refractory industries.

Obituaries

Ernest F. Harder, aged 71, assistant to the vice-president of the Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn., and for 40 years prominently identified with the electrical manufacturing business, died at his home at East Orange, N. J., following an attack of pneumonia.

Clark P. White, age 60, who operated the Cook stone quarry at Hopkinsville, Ky., was found dead in his home December 25. It is believed that death was caused by gas fumes from a new gas oven on which he had forgotten to turn off all the burners. His three sons who survive him, William, Carl and Robert, are also associated in the quarry business.

E. H. Pearson, New York district manager of Electric Machinery Mfg. Co., Minneapolis, Minn., succumbed suddenly on the morning of December 7. Mr. Pearson entered the employ of Electric Machinery Mfg. Co. as a service engineer in 1916, and served in various capacities until his appointment in 1928 as manager of the New York district office.

Fred D. Holdsworth, engineer in charge of air compressor design for the Sullivan Machinery Co. at its Claremont, N. H., plant, died recently. Mr. Holdsworth was associated with the Sullivan organization from 1900 until his retirement about a year ago, and during that period was awarded nearly fifty patents connected with the development of various Sullivan machines.

Maurice A. Oudin, 63, vice-president of the International General Electric Co., died at his home in Schenectady, December 4, following an illness with pneumonia. Mr. Oudin graduated from Princeton University in 1891 with the degrees of E. E. and M. S. and in the same year joined the Thomson-Houston Electric Co., Lynn, Mass., and continued in various capacities with its successor, the General Electric Co., at Schenectady. He was

made manager of the foreign department in 1904 and traveled extensively in Russia, China and Japan. In 1919, when the International General Electric Co. was formed to take over all foreign business of the parent company, Mr. Oudin was appointed its first vice-president.

Personals

Bert Koenig of the Koch Sand and Gravel Co., Evansville, Ind., has been appointed a member of the Evansville park board for a term of four years. Mr. Koenig is an active civic worker in Evansville.

Col. Robert W. Stewart, former chairman of the board of the Standard Oil Company of Indiana, has been elected a director of the Indiana Limestone Co., Bedford, Ind.

Richard S. Graham, of the bond department of the M. & T. Trust Co., Buffalo, N. Y., has been elected a director of the Federal Portland Cement Co., Inc., Buffalo, to succeed George P. Rea, who resigned.

Frank Purnell has been appointed president of the Youngstown Sheet and Tube Co., Youngstown, Ohio, succeeding James A. Campbell, who becomes chairman of the board of directors. Mr. Purnell has been with the company for 27 years.

Oscar Merkle, employe of the Wapakoneta Sand and Gravel Co., Wapakoneta, Ohio, had a narrow escape from death while working at the plant when a large chain used in hoisting broke, the falling end striking him on the back of the head and shoulders. He suffered scalp wounds and brain concussion.

Dr. H. A. R. Zehrlaut, president of the Plastic Stone Products Corp., New York City, was granted a professional engineer's license at the November meeting of the University of the State of New York. Dr. Zehrlaut is leaving shortly for a trip to Central and South America to study business conditions in the building materials trade in those countries.

Erwin E. Dreese, chief engineer of the Lincoln Electric Co., Cleveland, Ohio, has been appointed professor of electrical engineering at Ohio State University, as part of a program of adding more men of national reputation to the faculty of that institution. Professor Dreese has engaged in many projects of engineering investigation and research, and since joining the Lincoln Electric Co. five years ago has presented numerous papers before engineering societies.

A. F. Marwick, formerly general sales manager for the Pettibone-Mulliken Co., has joined the Chicago district sales staff of the Taylor-Wharton Iron and Steel Co. and Wm. Wharton, Jr., & Co., Inc. **G. V. Wood**, previously located at the High Bridge, N. J., plant of Taylor-Wharton, is now western sales manager for the company and its associated companies, with headquarters at San Francisco, Calif. **J. R. Van Rensselaer**, who has been sales representative for Taylor-Wharton's San Francisco distributor, is now located at the New York office of William Wharton, Jr. & Co., Inc.

Manufacturers

Caterpillar Tractor Co. within the next 90 days will employ an additional 2000 men in its enlarged combine and tractor factories and foundry at Peoria, Ill., which are nearing completion.

Dings Magnetic Separator Co., Milwaukee, Wis., announces the appointment of G. A. Reinhard as representative in the Cleveland territory, with offices at 1836 Euclid Ave.

Stephens-Adamson Mfg. Co., Aurora, Ill., has recently established a new branch engineering and sales office at 521 Skinner Bldg., Seattle, Wash., under the supervision of Charles J. Horn, formerly assistant chief engineer for the company.

Link-Belt Co.'s exhibit at the Road Show at Atlantic City will be in space No. 321, Section C, on the main floor of the convention hall. G. H. Olson, A. Eilersgaard, N. A. Weston and others from the Link-Belt organization will be in attendance.

Hetherington and Berner, Indianapolis, Ind., has been merged with the Robert Berner Structural Steel Co. and the firm will be known hereafter as Hetherington and Berner, Inc. The combined organizations of the two companies are now operating at the Hetherington and Berner plant, Indianapolis.

Dixie Machinery Mfg. Co., St. Louis, Mo., announces the opening of a Chicago office at 236 N. Clark St. under the supervision of J. H. Hock. The company has also opened an office at 104 Pearl St., New York City, under the supervision of George R. Horner.

Hercules Motors Corp., Canton, Ohio, has received the third large order for engines from the Soviet government, making a total of 3000 Hercules engines sold for use in Russia for the year. The latest contract calls for delivery of 1000 WX and YX series heavy-duty six-cylinder engines.

Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn., has let contract for the erection of a manufacturing plant at Bloomfield, N. J., for the Westinghouse Lamp Co., its subsidiary. The new operation will involve approximately $700,000.

Walker Vehicle Co., Chicago, motor truck manufacturer, has purchased the capital stock of Barrett-Cravens Co., Chicago, manufacturer of lift-trucks, lift-truck platforms, portable elevators, etc., and the ownership and management of these two companies and the Automatic Transportation Co., Inc., Buffalo, N. Y., will be linked together.

Leeds and Northrup Co., Philadelphia, Penn., held a minstrel show and dance Friday, December 13. The event was in celebration of an addition to the company's plant, which has doubled in size in the last year, and to welcome new members of the organization, grown in number during the same period from 750 to 1150.

Linde Air Products Co., New York City, announces the opening of an oxygen plant at 60 Knott St., Portland, Ore. The plant is located on a private siding on the Oregon-Washington railroad. A. D. Davis is superintendent and D. F. Fox, whose headquarters are at 114 Sansome St., San Francisco, Calif., is district superintendent.

Young Radiator Co., Racine, Wis., will exhibit its industrial power units, truck and bus radiators at the annual Road Builders Show and convention at Atlantic City, N. J., on January 13-18. The company's exhibit will be in space 504, and representatives attending will be F. M. Young, president; J. J. Hilt, sales manager; W. L. Walton, sales engineer, and D. A. Hisey, superintendent.

Wagner Electric Corp., St. Louis, Mo., announces the removal of two branch sales offices. The Milwaukee sales office and service station has been moved from 501 Broadway to 525-27 Broadway. The St. Louis sales office has been moved from 505 Shell Bldg. to 909 Plaza Olive Bldg. The company has moved its Chicago sales office and service station to 1935 Indiana Ave., Chicago.

Speeder Machinery Corp., Cedar Rapids, Iowa, will exhibit in space No. 312 at the Atlantic City Road Show. Headquarters of the company will be at the Knickerbocker Hotel and among those in attendance will be T. M. Deal, sales manager; H. W. Parsons, assistant sales manager; Edgar McNall, advertising manager, and various district managers.

Bethlehem Steel Corp., Bethlehem, Penn., will acquire the Pacific Coast Steel Co. and the Southern California Iron and Steel Co. The properties to be acquired include steel manufacturing plants located at South San Francisco, Los Angeles and Seattle. The plants have a steel ingot capacity of 380,000 gross tons per year and produce billets, reinforcing bars, forgings, bolts, nuts, rivets and other miscellaneous steel products.

E. I. du Pont de Nemours and Co., Wilmington, Del., has entered into a contributory group accident and health insurance contract with the Equitable Life Assurance Society to extend the benefits of accident and health insurance to approximately 30,000 employes. This insurance supplements group life insurance under the auspices of the Equitable, purchased by the company in 1919, which today amounts to $24,000,000.

Link-Belt Co., Chicago, Ill., will exhibit a complete line of equipment for handling, washing and screening sand and gravel at booths 53 and 54 of the National Sand and Gravel convention at the Peabody Hotel, Memphis, Tenn., and various devices of interest to crushed stone producers in booths 27 and 28 at the National Crushed Stone Show at the Gibson Hotel, Cincinnati. C. S. Huntington, H. L. Strube and A. K. Schifflin will be in attendance at both shows.

S K F Industries, Inc., of New York City, will display a range of ball and roller bearings in its exhibit (Space 438) at the coming Atlantic City convention and Good Roads Show of the American Road Builders Association. During the show, headquarters will be maintained at the Hotel Traymore, Atlantic City, N. J. Among the members of the company in attendance will be R. H. De Mott, sales manager; C. H. Brunner, chief engineer; F. E. Ericson, assistant sales manager, and a number of the company's district managers.

National Equipment Corp., Milwaukee, Wis.—a consolidation of the Koehring and T. L. Smith companies of Milwaukee, the Insley Mfg. Co. of Indianapolis, Parsons Co. of Newton, Iowa, and the Kwik-Mix Concrete Mixer Co. of Port Washington, Wis.—became an operating company on January 1, 1930. Philip A. Koehring is president and general manager of the new organization, with headquarters at 31st and Concordia Ave., Milwaukee. R. E. Brooks is vice-president in charge of sales.

Sullivan Machinery Co., Chicago, Ill., has established a branch office at Johannesburg, South Africa, to be known as Sullivan Machinery Co., Africa, (Proprietary) Ltd., Geneva House, Johannesburg, Transvaal. Charles C. Smith, manager for Barlow's Johannesburg (Proprietary) Ltd., Sullivan agents in South Africa, will be manager of the new office. Messrs. Barlow's Johannesburg (Proprietary) Ltd., and Thomas Barlow and Sons (S. A.) Ltd., Durban, Natal, continue as Sullivan agents in their respective territories. A branch office, warehouse and service station for Sullivan equipment has also been established at N'Dola in Northern Rhodesia.

Trade Literature

NOTICE—Any publication mentioned under this heading will be sent free unless otherwise noted, to readers, on request to the firm issuing the publication. When writing for any of the items kindly mention ROCK PRODUCTS.

Trench Supporter. Bulletin covering trench supporter for use with any style trencher. Eliminates cave-ins without sheathing or bracing. GREIMAN DITCHER CO., Minneapolis, Minn.

Vibrating Screens. Catalog **No. 90**, giving construction details, capacity and screening tests on various materials for Universal screens. UNIVERSAL VIBRATING SCREEN CO., Racine, Wis.

Crushers. Leaflet **No. 2116** outlining advantages of Newhouse Style "B" crushers and how they increase crushing plant efficiency. ALLIS-CHALMERS MFG. CO., Milwaukee, Wis.

Portland Cement. Economies effected with the use of "Incor" Perfected High-Early-Strength portland cement for winter construction are outlined in an attractive booklet circulated by the INTERNATIONAL CEMENT CORP., New York City.

Snow Fighting Equipment. Various types of snow-fighting equipment for "Caterpillar" tractors are pictured and described in a booklet entitled "Snow Removal Equipment." CATERPILLAR TRACTOR CO., San Leandro, Calif.

Car Dumper. Book **No. 1004**, illustrating and describing rotary railroad car dumper, designed for the rapid and economical unloading of all types of open-top cars delivering bulk materials. LINK-BELT CO., Chicago, Ill.

Coal Pulverizers. Bulletin entitled "Black-Stone," describing air-swept tube mill system for delivering "superfine pulverized carbureted fuel" to the combustion chamber. KENNEDY-VAN SAUN MFG. AND ENGINEERING CORP., New York City.

Oxwelded Piping. A 24-page booklet giving helpful and instructive information on the installation of oxy-acetylene welded piping for industrial uses and also for the heating of domestic and industrial buildings. LINDE AIR PRODUCTS CO., 30 East 42nd St., New York City.

Bucket Loader Equipped with High Capacity Screen. Folder **42C-1029-MW** covering compact one-man crawler mounted self-feeding unit for screening coke. Unit consists of bucket loader equipped with a high speed, high capacity screen. BARBER-GREENE CO., Aurora, Ill.

Crushers and Pulverizers. Illustrated catalog **462** completely describing crushers and pulverizers for the cement, crushed stone, lime and allied industries. Contains all specifications. WILLIAMS PATENT CRUSHER AND PULVERIZER CO., St. Louis, Mo.

Sand-Lime Brick. The use of sand-lime brick in construction is treated in an interesting broadside which is being circulated by the combined Grande Brick Co., Northern Indiana Brick Co., Saginaw Brick Co. and JACKSON BRICK CO., Jackson, Mich.

Furnace Fans. Fans for warm air furnaces is the subject of the new Wagner bulletin **No. 166**. The bulletin discusses in detail the advantages of installing furnace fans in the cold air intakes of warm air furnaces. WAGNER ELECTRIC CORP., St. Louis, Mo.

Valves. Catalog **No. 7** covering complete line of Nordstrom valves, parts and accessories and "Merco" lubricants, with special information such as a temperature conversion table, pressure ratings, and table showing conversion of lengths—inches and millimeters. MERCO NORDSTROM VALVE CO., San Francisco, Calif.

Temperature Control Instruments. A 32-page book, entitled "Steel Treating Instrument Data Book," giving an interesting picture of the important part played by indicating and automatic control pyrometer equipment in modern heat treating operations. THE BROWN INSTRUMENT CO., Philadelphia, Penn.

Center-Drive Crawlers. Folder describing the new "56" Tread Crawler for the 1¼-yd. Lorain-75, improved features of which are increased length, improved truck bed casting, and more powerful center drive. Bulletin also describes various other tread center-drive crawlers. THE THEW SHOVEL CO., Lorain, Ohio.

G. E. Bulletins. GEA-876-C superseding 876-B on the type WD-400-A arc welder; GEA-752-A on D. C. motors, type BD; GEA-571-C on arc welding accessories; GEA-724-B on totally enclosed, fan-cooled squirrel-cage motors, "900 series"; GEA-1009-A on type WD-300-A arc welder, Buda gas-engine-driven; GEA-416-B on automatic starting compensators for squirrel-cage induction motors. GENERAL ELECTRIC CO., Schenectady, N. Y.